THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LVI. No. 1435.] LONDON, NOVEMBER 11, 1890. [42ND YEAR. Price 6d.

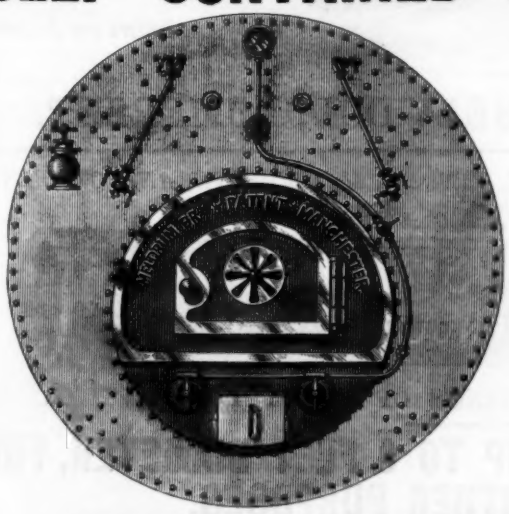
WOLSTON'S Paste and Ready Mixed for Use.
Guaranteed Free from Adulteration. **TORBAY PANTS.**
FOR GASHOLDERS, &c., &c.
The Original "Torbay Paints"
As supplied during the present and many preceding years to the LONDON GASLIGHT & COKE COMPANY.
Special Quotations to Gas Companies.
TORBAY & DART PAINT Co., Ld.,
23, Gt. George St., Westminster, S.W.
Works: DARTMOUTH, DEVON.

— ESTABLISHED 1830. —
PARKER & LESTER,
Manufacturers & Contractors.
THE ONLY MAKERS OF
PATENT ANTIMONY PAINT,
Parker's Imperial Black Varnish,
Oxide Paints, Oils, and General Stores for Gas and Water Works.
WORKS:
ORMSIDE STREET, OLD KENT ROAD, LONDON.
Ashmore, Benson, Pease, & Co., Ld.,
STOCKTON-ON-TEES,
Manufacturing Gas Engineers.
See Advertisement, p. 820.

CEMENT
EARLE'S
BEST
Portland Cement
MANUFACTURED BY
GEO. & THOS. EARLE,
HULL.
Office: 7, PIER STREET.
Works: WILMINGTON.
STOREAGE CAPACITY 10,000 Tons.
ESTABLISHED 1811—OVER THREE QUARTERS OF A CENTURY.
Telegraphic Address: "CEMENT HULL."

J. UNGAR & CO.,
Manufacturers & Patentees of every Description of
IMPROVED LAMPS
FOR
Streets, Markets, Shops, &c.
WHOLESALE DEPOT: 52, COMMERCIAL ST., LONDON, E.
We specially solicit Government and Local Board Contracts for General Lighting.

SELF-CONTAINED DUST FUEL FURNACE.



OVER 200 WORKING,
RAISING STEAM WITH COKE DUST, COAL DUST, TOWNS' REFUSE, AND OTHER WASTE FUEL.

GLASGOW: F. J. ROWAN, 121, West Regent Street
LONDON: WM. BOBY, 16, Union Court, Old Broad Street
GERMANY, AUSTRIA, BELGIUM, SWITZERLAND, ITALY } ALFRED WENNER, Manchester.

MELDRUM BROS.,
26, HALF STREET, MANCHESTER.

DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

GASHOLDER & BOILER WORKS,

WEST BROMWICH, NEAR BIRMINGHAM

(ESTABLISHED 1765),

MANUFACTURER OF TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST IRON TANKS FOR DITTO,

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, and all kinds of GAS APPARATUS,

Wrought-Iron Roofs, Bridges, Girders, &c.,

Steam, Hot Water, and Range Boilers, Tanks, Cisterns, Boats, and all kinds of Wrought-Iron Work.

DRAWINGS, SPECIFICATIONS, AND ESTIMATES SUPPLIED ON APPLICATION.

TELEGRAPHIC ADDRESS: "COCKEY'S FROME."

EDWARD COCKEY & SONS, Ld.,

ESTABLISHED OVER HALF A CENTURY.

Gas Engineers and Contractors for the Erection of Gas-Works.

MANUFACTURERS OF IMPROVED GAS-EXHAUSTING APPARATUS.

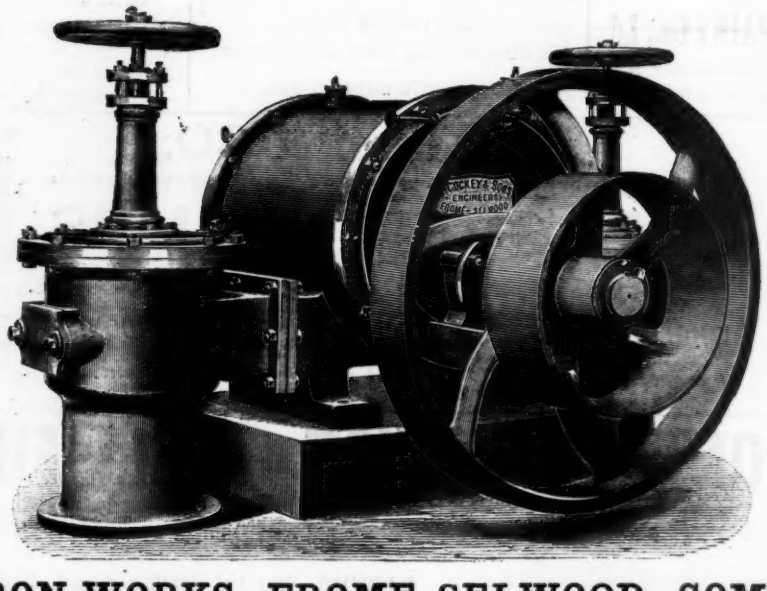
A Large Stock of Valves always on hand.

Lamp Columns; various patterns.

Wood Grids for Purifiers and Scrubbers.

Castings of every description.

Apparatus for the manufacture of Sulphate of Ammonia.



Experienced Retort-Setters constantly employed.

Lead Burning and Plumbing in all its Branches.

Gas-Fittings in great variety.

Brass Castings.

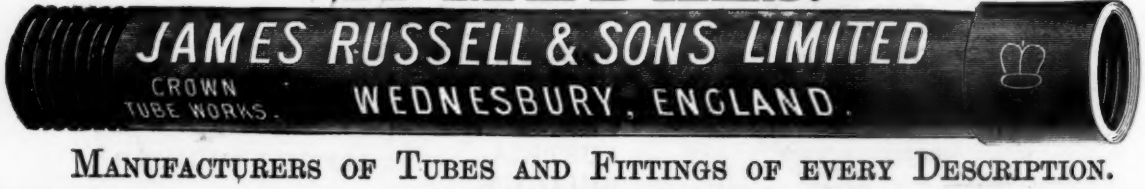
Patent Washers and Valves.

Boilers and Engines.

THE IRON-WORKS, FROME SELWOOD, SOMERSET.

HIGHEST AWARDS—LONDON, PARIS, COLOGNE, VIENNA, MELBOURNE, AND OTHERS.

—11 MEDALS.—



MANUFACTURERS OF TUBES AND FITTINGS OF EVERY DESCRIPTION.

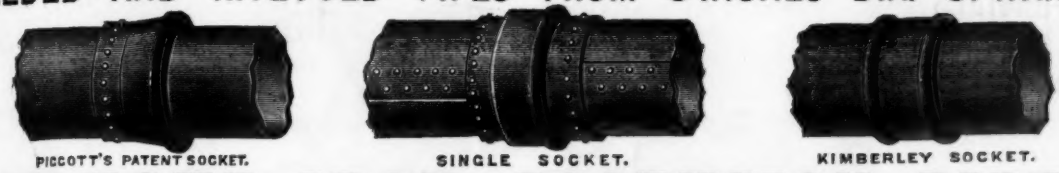
WROUGHT-IRON OR STEEL MAINS UP TO 6 FEET DIAMETER, FOR GAS, WATER, OIL, OR OTHER PURPOSES.

SCREWING TACKLE, BOILER MOUNTINGS, VALVES, COCKS, ETC.

LONDON: 108, Southwark Street. BIRMINGHAM: 114, Colmore Row. LEEDS: 6, Mark Lane, New Briggate.

THOS. PIGGOTT & CO., ATLAS WORKS, BIRMINGHAM.

WELDED AND RIVETTED PIPES FROM 8-INCHES DIA. UPWARDS.



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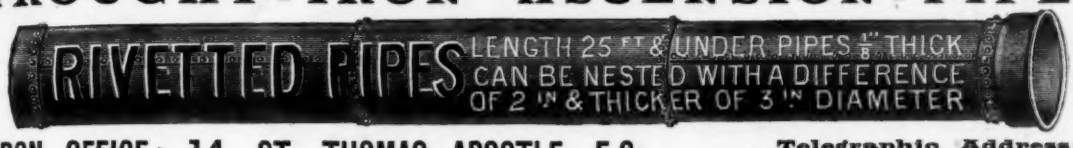
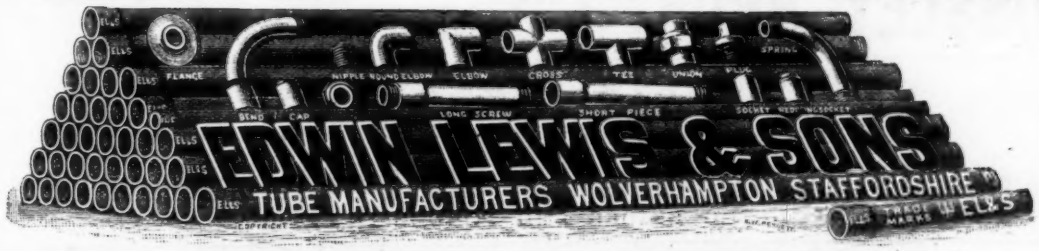


LONDON OFFICE: 14, ST. THOMAS APOSTLE, E.C. Telegraphic Address: "ATLAS BIRMINGHAM."

ESTABLISHED 1825.

GAS TUBES



MANUFACTURERS OF EVERY DESCRIPTION OF

IRON OR STEEL LAP-WELDED OR BUTT-WELDED TUBES

FOR ANY PURPOSE.

NEWTON, CHAMBERS, & CO., LIMITED,

THORNCLIFFE IRON-WORKS, near SHEFFIELD,

SLIDE VALVES, WITH RACK & PINION, OR Internal or External SCREWS, of all Sizes.

GASHOLDERS, AND Gasholder Tanks.

CAST-IRON RETORTS,

RETORT-BED FITTINGS,

And Retort-House Appliances

of every description.

Iron Roofs, Columns, Girders, Floor Plates and Tools, &c.

MANUFACTURERS OF WROUGHT AND CAST IRON

CONDENSERS, SCRUBBERS, & WASHERS,

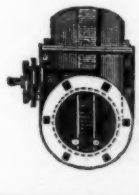
TAR AND LIQUOR PUMPS, &c.

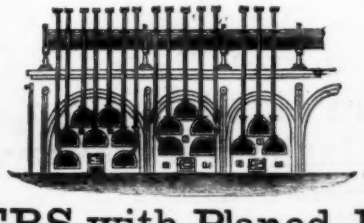
PATENT

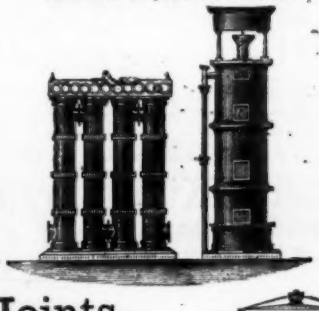
CENTRE VALVES

for working Purifiers.

Also Bye-Pass & Stop Valves.





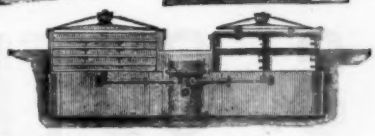


PURIFIERS with Planed Joints,

HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS and SPECIALS,

WOOD GRIDS.

CAST AND WROUGHT IRON TANKS AND CISTERNS.



DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

CROSSLEY'S "OTTO" GAS-ENGINE.

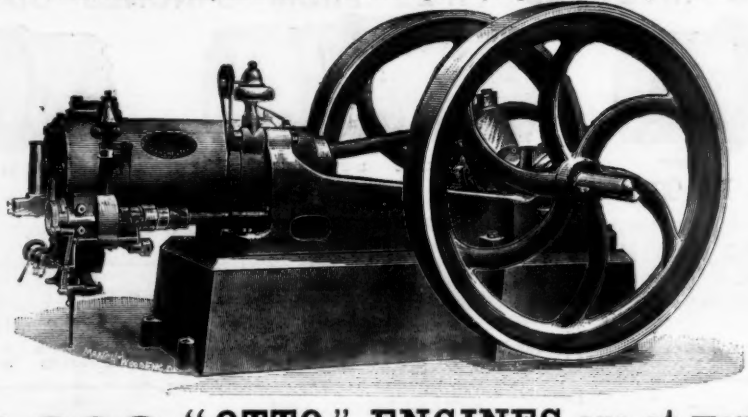
100 Prize Medals.

MADE in SIZES
2-Man to 100-HP.

GAS-ENGINES
COMBINED
WITH
PUMPS
FOR
TOWNS SUPPLY,
SEWAGE, &c., &c.

GAS-ENGINES
COMBINED
WITH
AIR COMPRESSORS
FOR THE
SHONE SEWAGE
SYSTEM, LUCIGEN
LIGHT, &c.

New 14-H.P. Nominal Size, fitted with Patent Tube Ignition, dispensing entirely with Plates.



MADE in SIZES
2-Man to 100-HP.

VERTICAL
AND
HORIZONTAL
TYPES.

ENGINES
COMBINED
WITH
HOISTS, PUMPS
DYNAMOS, &c., &c.

Largely used for
EXHAUSTING,
PUMPING,
COKE CRUSHING,
ELECTRIC LIGHTING,
&c., &c.

Over 31,000 "OTTO" ENGINES are at work.

CROSSLEY BROS., LTD., OPENSHAW, MANCHESTER,

LONDON,
LIVERPOOL,
GLASGOW,
NEWCASTLE,
BIRMINGHAM,
HULL.

HARRIS & PEARSON,
STOURBRIDGE, ENGLAND.
MANUFACTURERS OF
FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.
GLAZED BRICKS AND PORCELAIN BATHS.

CUTLER'S PATENT FREEZING PREVENTER

For Avoiding formation of Ice in Telescopic Gasholder Cups.

SIMPLE, SAFE, EASILY APPLIED, EFFECTIVE.

Adopted by The Gaslight and Coke Company, London.
The Imperial Continental Gas Association.
The Bromley (Kent) Gaslight Company.
The Great Yarmouth Gaslight Company.
The Kings Lynn Gaslight Company.
The Hertford Gaslight Company, &c.

S. CUTLER and SONS,

OFFICES:
16, GREAT GEORGE ST.,
WESTMINSTER, S.W.

WORKS:
PROVIDENCE IRON-WORKS,
MILLWALL, LONDON, E.

JOSEPH CLIFF & SONS,

INCORPORATED IN
THE LEEDS FIRE-CLAY COMPANY, Ltd.,
WORTLEY, LEEDS.

LONDON Offices & Depôts:
Baltic Wharf, Waterloo Bridge.
WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.
LIVERPOOL:
16, Lightbody Street.
LEEDS:
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MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.

Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

ESTABLISHED MORE THAN A QUARTER OF A CENTURY

WORKS
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LEEDS

LONDON OFFICE:
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CLAYTON SON & CO. LTD.

MAKE A SPECIALTY OF GASHOLDERS

AND MAKERS OF
GAS PLANT OF EVERY DESCRIPTION.

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JOHN BROWN & CO., LTD., SHEFFIELD,

Proprietors of
ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

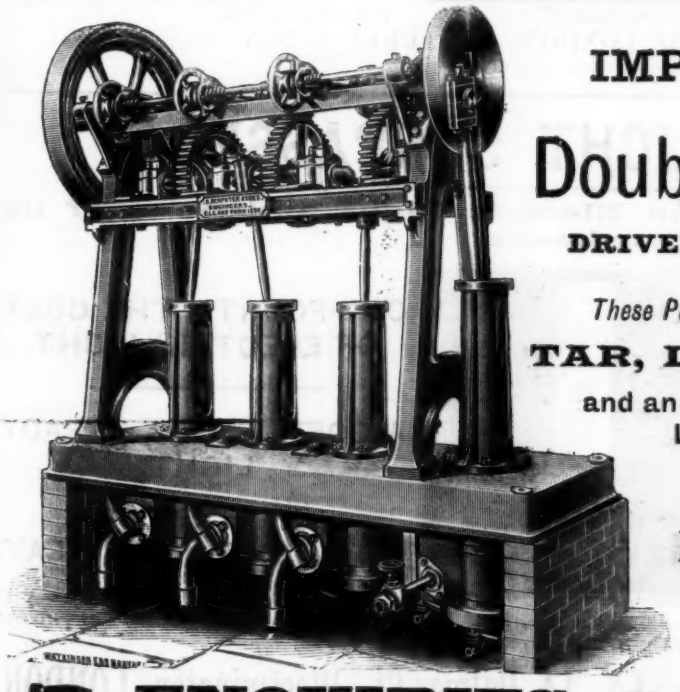
ALDWARKE MAIN GAS COAL

Analysis: 12,600 feet of 19-candle gas per ton.
Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.
Telegrams: "ATLAS SHEFFIELD."

R. DEMPSTER & SONS, Ltd.,

GAS, CHEMICAL, & HYDRAULIC ENGINEERS & CONTRACTORS,

ESTABLISHED — **ELLAND.** — 1855.



IMPROVED BATTERY
OF THREE
Double-Acting Pumps
DRIVEN BY ONE STEAM-ENGINE.

These Pumps are fitted with Valves for pumping
TAR, LIQUOR, and WATER,
and an arrangement by which any of these Liquids may be pumped together or separately.

BEST MATERIALS AND WORKMANSHIP,
AND
EFFICIENCY GUARANTEED.

ENQUIRIES SOLICITED.

JOHN HALL & CO.,

STOURBRIDGE,

MANUFACTURERS OF FIRE-BRICKS, LUMPS, TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

RETORTS CAREFULLY PACKED FOR SHIPMENT.

A STOCK OF DIFFERENT SHAPES ON HAND.

GAS AND WATER PIPES

AND

CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

CLAY CROSS COMPANY,

CHESTERFIELD.

TRADE	TELEGRAMS:	LONDON AGENTS:
C X C	"JACKSON"	BECK & Co.,
MARK.	CLAY CROSS.	130, GT. SUFFOLK ST., S.E.

SULPHATE OF AMMONIA.

By Her Majesty's Royal Letters Patent.

DR. FELDMANN'S APPARATUS

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICES APPLY TO THE

Sole Agents and Manufacturers,

GODDARD, MASSEY, & WARNER,

ENGINEERS,

NOTTINGHAM.

The Apparatus has been supplied to the following Firms–

BURT, BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (4 Apparatus).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited, SHADWELL.
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And to the following Gas Companies and Corporations–

ILKESTON.	BURY.	CHORLEY.
WIDNES	BRIGHOUSE.	WHITEHAVEN.
HALIFAX.	MARKET HARBRO'.	CHESTER.
ALTRINCHAM.	PRESCOT.	SOUTH SHIELDS.
DENTON.	SOWERBY BRIDGE.	LEEK.
ST. ALBANS.	LEICESTER.	IPSWICH.
DUKINFIELD.	DARWEN.	BOURNEMOUTH.
NORTHWICH.	NELSON.	SALFORD.
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THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

MIDLAND DISTRICT OFFICE: 22, TEMPLE ST., BIRMINGHAM—SOLE AGENT: A. C. SCRIVENER.

TELEGRAPHIC ADDRESS: "WIGAN BIRMINGHAM." TELEPHONE No. 200.

LONDON DISTRICT OFFICE: 6, STRAND, LONDON—C. PARKER & SON, SOLE AGENTS.

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ELECTRIC LIGHT SURPASSED.

All the advantages of the Electric Light and none of its drawbacks.

EVERY GAS COMPANY SHOULD TAKE UP THIS SYSTEM.

CAN BE USED WITH ANY GAS-FITTINGS.

ONE-FOURTH THE COST OF ELECTRIC LIGHT.

A SOFT, CLEAR, STEADY LIGHT.

NO SMOKE. LESS HEAT.

Gas Companies and Gas Engineers placed on the best terms. For descriptive circulars and any further particulars, apply to the

INCANDESCENT GAS-LIGHT CO., Ld., 14, Palmer St., Westminster, LONDON.

KIRKHAM, HULETT, & CHANDLER'S, LTD.,

NEW PATENT

"STANDARD" WASHER.

EXTRACTS the WHOLE of the AMMONIA

Also a Large Proportion of H_2S and CO_2 from Gas.

MINIMUM WEIGHT IN MOTION.
MINIMUM DRIVING POWER.
MINIMUM BACK PRESSURE.
MINIMUM WEAR AND TEAR.
WITH MAXIMUM RESULTS.

The following List comprises the orders received for PATENT "STANDARD" WASHERS constructed according to the Company's latest patent, and Renewals effected by the application of same to old pattern Machines.

NEW PATENT "STANDARD" WASHERS.

The Gaslight and Coke Company—	Capacity, cub. ft. per 24 hours.
Kensal Green	3,000,000
,,	3,000,000
West Ham	3,000,000
Liverpool	3,000,000
Rochdale	3,000,000
Manchester	2,500,000
Glasgow	2,500,000
,,	2,500,000
Leicester	2,250,000
Melbourne	1,500,000
Charlottenburg	1,500,000
Derby	1,500,000
,,	1,000,000
Cambridge	1,000,000
Nice	875,000
Barcelona	875,000
Magdeburg	750,000
Valparaiso	600,000
Halle	600,000
Barry and Cadoxton	500,000
Workington	500,000
Lowestoft	500,000
Erfurt	400,000
St. Chamond	350,000
Atlas Steel Works, Sheffield	250,000
Lille	250,000
Rawmarsh	200,000
Vercelli	200,000
Hitchin	150,000

RENEWALS.

The Gaslight and Coke Company—	Capacity, cub. ft. per 24 hours.
Beckton	2,500,000
,,	1,250,000
Nine Elms (in part)	3,000,000
Shoreditch ,,	2,500,000
Pimlico ,,	2,000,000
Bromley ,,	2,000,000
South Metropolitan Gas Company—	
Vauxhall (in part)	3,000,000
Birmingham ,,	5,000,000
Croydon	1,500,000
Edinburgh	1,500,000
West Ham	1,500,000
Nottingham	1,500,000
Melbourne	1,500,000
,,	1,500,000
Maidstone	1,000,000
Kingston-on-Hull	400,000
Harrow	250,000
Buxton	250,000

Testimonial from the Chief Engineer of The Gaslight & Coke Co.

The Gaslight and Coke Company, Horseferry Road, Westminster, S.W., Nov. 25, 1889.

Messrs. Kirkham, Hulett, and Chandler, Limited,

Gentlemen,—In reply to your enquiry respecting the result of putting "Wooden Bundles" into some of the Washer-Scrubbers at our Beckton Station, I beg to say they have answered admirably for the few months they have been in; and I think them a decided success.—I am, yours truly,

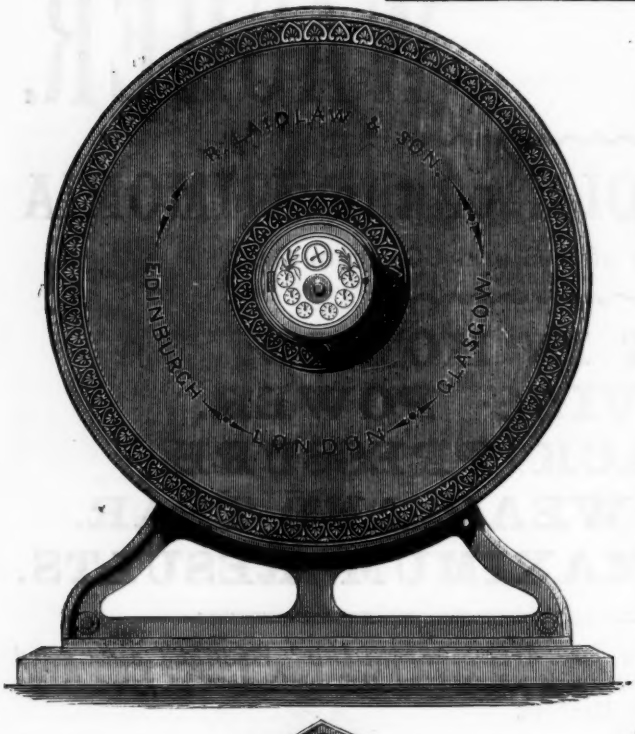
(Signed) G. C. Trewby.

NOTE.—The first Washer referred to in the above was fitted with improved "Bundles" in May, 1888; and these have proved so satisfactory that The Gaslight and Coke Company have had several other "Standard" Washers fitted in the same manner, and have recently given an order for machines for 6,000,000 cubic feet per day.

PALACE CHAMBERS, BRIDGE STREET,

WESTMINSTER, S.W.

R. LAIDLAW & SON'S
STATION METERS
IN ROUND OR SQUARE CASES, ALL SIZES.

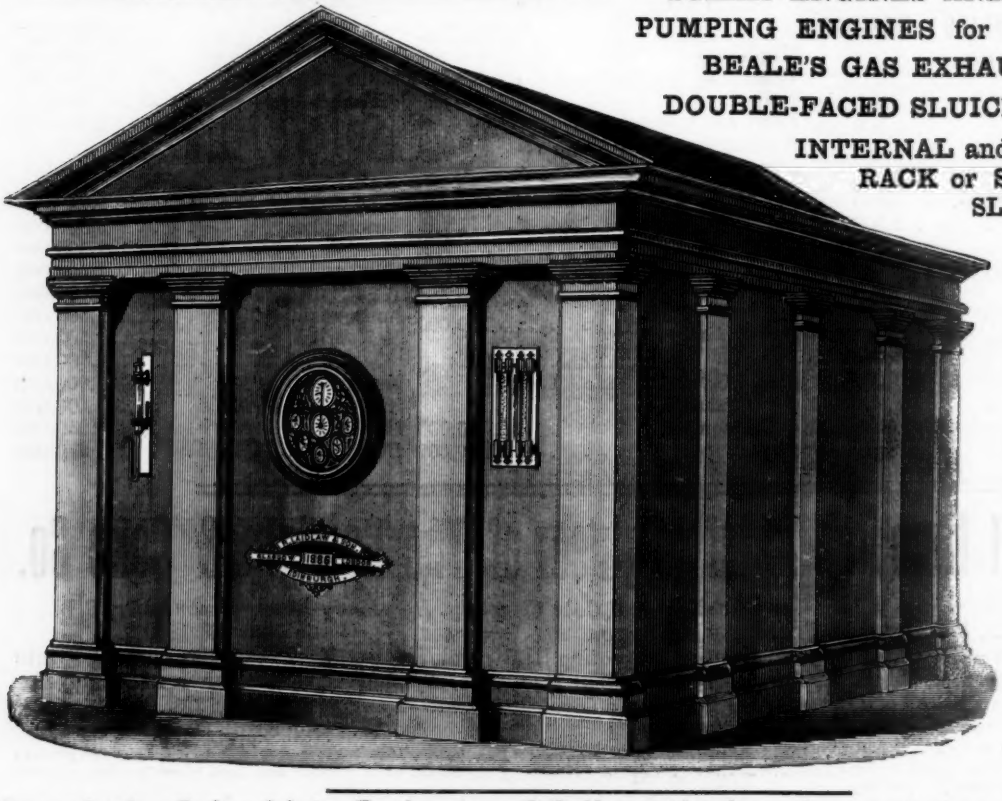


Makers in EDINBURGH of

WET AND DRY GAS-METERS,
IMPROVED STATION GOVERNORS,
PRESSURE REGISTERS,
(To Indicate New Time),
PRESSURE GAUGES, TEST HOLDERS,
EXPERIMENTAL HOURLY-RATE METERS,
EXPERIMENTAL TEST-METERS,
CONDENSER THERMOMETERS,
SIEMENS' WATER-METERS,
STREET LANTERNS,
AND ALL KINDS OF
GAS APPARATUS AND FITTINGS, &c.

Makers in GLASGOW of

CAST-IRON PIPES (all Sizes),
LAMP PILLARS,
STEAM-ENGINES AND BOILERS,
PUMPING ENGINES for Water-Works,
BEALE'S GAS EXHAUSTERS,
DOUBLE-FACED SLUICE VALVES,
INTERNAL and EXTERNAL RACK or SCREW SLIDE VALVES,
CAST-IRON COLUMNS,
BEAMS, GIRDERS, and WATER TANKS.
WROUGHT-IRON TUBES, FITTINGS, &c.



Descriptive Price Lists, Estimates, & full particulars forwarded on application.

ALLIANCE FOUNDRY, **GLASGOW.** | SIMON SQUARE WORKS, **EDINBURGH.** | 6, LITTLE BUSH LANE, **LONDON, E.C.**

IMPORTANT TO
GAS ENGINEERS AND GAS MANAGERS:

The most Economical, Reliable, and Handy Tool for Forge Work for

ENGINEERS, MACHINISTS, TOOL MAKERS, FITTERS, FORGERS, STAMPERS, COACH BUILDERS,

AND FOR USE IN

GAS-WORKS, SMITHIES, IRON-WORKS, COLLIERIES, &c., &c.,

IS

THE TANGYE GAS-HAMMER

(ROBSON & PINKNEY'S PATENTS)

As supplied to several of the principal Gas-Works.

TANGYES LIMITED
SOLE MAKERS.

As supplied to several of the principal Gas-Works.

(From Photos of the ¾ cwt. size.)

Hand Gear. **Foot Gear.**

THE above illustrations represent THE TANGYE GAS-HAMMER AS NOW made. Since its introduction it has been greatly improved both in design and simplicity of working. It has also been constructed to work either with Hand Gear or with Foot Gear.

This—the first Gas-driven Forging Hammer introduced—was designed, and at first recommended only for use in cases where steam was not available or could only be employed at great expense, but the data given below, and which are founded upon reliable and sustained test and trial, demonstrate that the **GAS-HAMMER** may be economically used in competition with the Steam-Hammer, even in places where the price of gas is at its highest.

"*Since the appearance of our* ['*The Engineer*'] *notice, the Hammer has been in some respects re-modelled, and its remarkable economy placed altogether beyond a doubt. . . . The Hammer described is that known as the ¾ cwt. size, and has a cylinder of 7 in. diameter and 6½ in. stroke. The maximum blow is very nearly that which would be given by* **a weight of 3 cwt. falling through a height of 1 ft.**; *and this can be repeated at the rate of* **110** *blows per minute. . . . Extended test in practical smith work has demonstrated that over* **2500 of the heavier blows** *referred to above, can be given with* **one pennyworth of gas** *at half-a-crown per* 1000 *feet—i.e., the Birmingham price to small consumers—or over* 4500 *varying blows for the same consumption.*"—"**The Engineer,**" **Sept. 10, 1886.**

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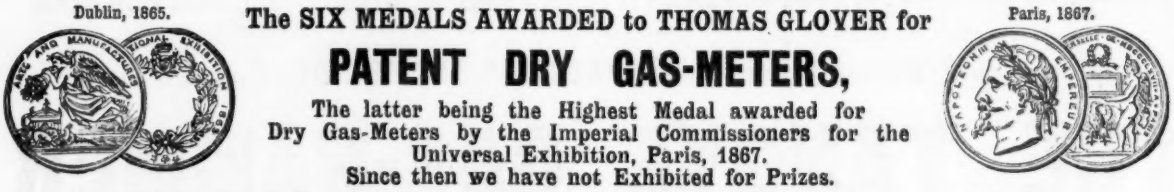

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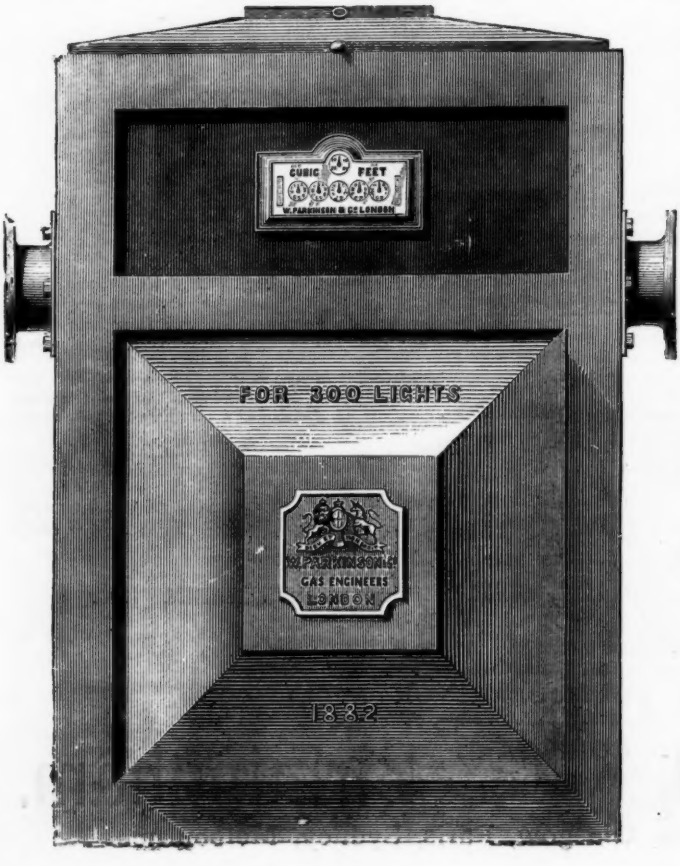

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CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE
A Slip on Both Sides . . . 987
The Meeting of the American Gaslight Association . . . 988
Electric Lighting in Central London . . . 988
Protection Abroad and at Home . . . 988
WATER AND SANITARY AFFAIRS—
The Half-Yearly Meeting of the West Middlesex Water Company—The Position of the Companies with regard to the Water Question . . . 989
The Metropolitan Authorities and the Water Supply . . . 989
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market . . . 990
Electric Lighting Memoranda . . . 990
The Imperfection of Gas Heating-Stoves . . . 991
A Neglected Department of Gas Consumption . . . 992
COMMUNICATED ARTICLES:—
The Gadd and Mason Gasholder: A Rejoinder to Mr. W. Gadd's "Review of a Criticism." By F. S. Cripps, Assoc. M. Inst. C.E. . . . 993
The Chemistry of Illuminating Gas. By Norton H. Humphrys, Assoc. M. Inst. C.E., F.C.S. . . . 995
REGISTER OF PATENTS:—
Gas Lighting Appliances—Rowson, F. G. and J. . . . 997
Water-Meters—Lake, H. H. (Rogers Liquid Meter Company) . . . 997
Water-Meters—Tarda, P. . . . 997
Testing Gas-Mains—Moat, G. . . . 998
Regenerative Gas-Lamps—Suhr, H. . . . 998
Tanks or Reservoirs—Pridham, T. . . . 998
Gas and Vapour Engines—Hamilton, J. H. and Rollason, A. . . . 998
Patent Notices . . . 998
CORRESPONDENCE:—
Gaseous Fuel . . . 999
Mr. Cripps and the Gadd and Mason System of Gasholder Construction . . . 999
The Temperature of Gas Flames . . . 999
The Gas Workers' Union and its Executive . . . 999
MISCELLANEOUS:—
The Water-Gas Experiment at Harrogate . . . 1000
The Salford Gas Frauds—Mr. Mandley again to the Front . . . 1001
Meeting of the Imperial Continental Gas Association . . . 1001
Meeting of the Bombay Gas Company, Limited . . . 1002
Meeting of the Australasian Gas Association, Limited . . . 1003
Meeting of the Georgetown (British Guiana) Gas Company, Limited . . . 1003
Gas Appliances at the Food and Cookery Exhibition . . . 1004
Aberdeen Corporation Gas Supply—Increase in the Price of Gas . . . 1004
Electric Lighting Schemes in London—Commencement of the St. Pancras Station . . . 1005
Electric Lighting of Croydon—A Report by Mr. W. H. Preece . . . 1005
Meeting of the West Middlesex Water-Works Company . . . 1006
Meeting of the Cape Town District Water Works Company, Limited . . . 1006
Notes from Scotland . . . 1007
Current Sales of Gas Products . . . 1008
Gas and Water Companies' Stock and Share List . . . 1009
PARAGRAPHS.—Presentation to Mr. W. E. Roberts, of Blackburn, 989—The New Gas-Works of the Rawmarsh Local Board, 989—The New Lord Mayor, 990—The Gas Question in Paris, 990—The Production of Coal in India, 990—Mr. J. H. Silcox, 991—Society of Arts, 991—Mr. T. Hudson Beare, 993—The Denver (Colorado) Water-Works, 993—Laying Mains round Curves, 993—Proposed Taxation of Subsoil Occupied by Gas and Water Pipes in Chicago, 997—Toronto Water Supply, 997—Derby Gaslight Company, 1001—Fraudulently Using Gas at Morecambe, 1003—The Combination of Local Authorities for Electric Lighting Purposes, 1003 Northern Coal Trade, 1003—Heywood Corporation Gas Supply, 1004—The Ennis Gas Company Fined for Breach of an Agreement, 1004—The Leamington Corporation and the Electric Light, 1004—Buenos Ayres (New) Gas Company, Limited, 1005—The Argentine Gas Company's Works at Buenos Ayres, 1005—Underground Pipes and Wires in the Metropolis, 1005—Glasgow Corporation Water-Works, 1005—Gas-Heated Baths, 1005—Destruction of Messrs. W. Parkinson and Co.'s Premises by Fire, 1008—Unloading Coke on the Public Footways in the Metropolis, 1008—The Price of Gas at Whitehaven, 1008—The Lancashire Coal Trade, 1008—The Oil Lighting Experiment at Erith, 1008—Southampton Gaslight Company, 1008—Gas Laundry-Machines, 1008—Sewerage Works at Maldon (Essex), 1009—Galvanized Iron Water-Pipes for South Africa, 1009—Sales of Shares, 1009—The Dangers of Electric Lighting, 1009—Electric Lighting at Preston, 1009—Wirksworth Water-Works, 1009.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, NOVEMBER 11, 1890.

A Slip on Both Sides.

CONSIDERABLE interest has been manifested, from different parts of the country, in the County Court case reported in the JOURNAL last week, in which a consumer in the district of the Brentford Gas Company recovered £15 damages against the Company for unlawful entry upon his premises for the purpose of cutting off the gas supply. We have not been able to obtain a full note of the proceedings in this case; but probably all the essential points were given in the published abstract. It will be noticed that the issue involved two points—the first being a general plea raised by the plaintiff, that the gas ought to have been cut off, if at all, without entry upon his premises; and the second being concerned with the framing of the cutting-off notice. The Gas Company lost the day primarily because the notice was illegal in form—not being under the hand of the Secretary. It should be unnecessary to state the law on this point; but evidently there was some misunderstanding about it at Brentford; and there may be the same in other places. By the Gas-Works Clauses Act, 1871, clause 22, it is enacted as follows:—

> In all cases in which the undertakers are authorized to take away and cut off the supply of gas from any premises, it shall be lawful for the undertakers, their agents or workmen, after twenty-four hours' notice in writing, *under the hand of the Secretary* or other properly authorized officer of the undertakers, to the occupier, or if unoccupied, then to the owner or lessee, or to the agent of the owner or lessee, *of any premises in which any pipes, meters, fittings, or apparatus belonging to the undertakers* are laid or fixed, and through or in which the supply of gas is from any such cause discontinued, to *enter such premises* between the hours of nine in the morning and four in the evening, for the purpose of removing and to remove such pipes, meters, fittings, or apparatus, repairing all damage caused by such entry or removal.

We give all the wording of this provision as it stands; italicizing those portions which require to be particularly studied in connection with the Brentford case. The first point to be noticed here is that all cutting-off notices requiring entry upon a consumer's premises must be under the hand of the Secretary; or, failing him for any sufficient reason, another officer appointed to act in his stead. If the Brentford notices were not issued in this form—and the result of the case under review is evidence that they were not—then very gross carelessness was shown, the effect of which is to bring odium upon the summary powers enjoyed by all statutory gas companies. When considering how such an error can have arisen, we shall find, on referring to clause 7 of the Gas-Works Clauses Act, 1847, which corresponds in intention to the clause of the 1871 Act already quoted, that there is no requirement for the notice to be signed by anybody in particular, but merely that "24 hours' previous notice" must be given—not necessarily even in writing. It would therefore appear that the Brentford notices conform to this enactment, which happens to have been repealed, instead of to the later and operative one. This is unfortunate for the Company.

The claim of the plaintiff in the case, that gas ought to be cut off outside the premises, which received the sympathy of both Judge and Jury in the County Court, is absurd; and it is regrettable that the Judge, who ought to have known better, should have gone out of his way to countenance it. The statute says plainly enough that it shall be lawful for gas-supply undertakers to enter upon premises under certain conditions; and the clause gives sufficient reason for this permission, which is that the undertakers have property on the premises. Does this County Court Judge think that gas companies who are obliged by law to place certain property of their own on other people's premises, are to be prevented from going to it for a proper purpose? This is a painful example of the irrepressible loquacity of some occupants of the lower judicial Bench, who are apt to allow their tongues to outrun their discretion. The worst of it is that juries and the public generally are naturally prone to take advantage of these ill-considered expressions from the Bench. In the present case, the Brentford jury gave the plaintiff consumer £15, which was decidedly "good business" for him, seeing that his unpaid gas account was only for 18s. 6d. Supposing him to get the money, it is probable that the gentleman would not be unwilling to see his domicile again outraged in a similar fashion on the same terms. The damages were plainly vindictive, and would hardly have been awarded on account of the technical informality of the cutting-off notice, if the Court had not encouraged the notion that the whole transaction was of a tyrannous and oppressive character. It is noteworthy that a London evening newspaper, in commenting upon the case as one of "importance to almost everybody," accepted the dictum of the County Court Judge as final, and remarked that it ought to be generally known for the comfort of householders. Thus is error spread; for a cursory intimation of this kind can never be overtaken by any later correction. Even supposing the Brentford County Court Judge to be reproved by his superiors for speaking inadvisedly with his lips, the newspapers would not be likely to promulgate the fact. It would not be so generally interesting, in the estimation of a newspaper sub-editor, to record an example of "monopolists" securing legal recognition of their rights, as it is to show how these may be infringed with impunity. Fortunately, if any members of that interesting order of

the community which does not pay its gas bills if it can help doing so, proceed, upon the presumed security of the Brentford ruling, to defy the supplying Gas Company to touch their own meters, they will speedily be taught that Acts of Parliament are not to be abrogated at the will of a County Court Judge.

The Meeting of the American Gaslight Association.

THE members of the American Gaslight Association met in the Southern city of Savannah, in the State of Georgia, on the 15th ult., under the presidency of Mr. Emerson M'Millin, of St. Louis; and, as recorded in our last issue, the meeting is reported as having been very successful in every respect. It was a long way to go for many members of the Association; and consequently several well-known names do not appear in the list of those present. Distance is of little or no object to Americans, when either pleasure or profit is to be obtained by travel. But time is of importance to busy men all over the world; and it looks as if more than one eminent gas engineer had replied in the negative, when asking himself whether, all things considered, it was quite worth while to attend the Association meeting in the old slave State. The fact of the matter is that the attractions of these large meetings, even when the "Local Reception Committee" is ideally competent, have their limits, especially for men whose position is to a certain extent assured. Poor men, again, cannot afford to go to the end of the world for two or three days upon business which is not directly remunerative, and is mixed, in a half-apologetic way, with pleasures of a conventional cast. The partisans and supporters of the American Gaslight Association would be loth to admit that their self-appointed area is larger than they can conveniently cover. But they are to meet next year in New York, and probably after that in Chicago; so that it looks as if they had an inkling that it does not pay to go too far afield. Another matter should be mentioned, as it has a bearing upon the experiences of other Societies of the kind. Hitherto the American Association has been uncomfortably notorious, in the estimation of its best friends, for its parasitic tendency—not to call it by a harsher name. It has displayed a marked willingness to accept banquets, free trips, and any other small mercies, at the hands of manufacturing and commercial firms identified with the places selected for its annual meetings. The best men in the Association, and the most respectable of the technical journals of the country, have protested again and again against this undignified course; and some have used language about the givers and expectors of these benefactions which in any other land would have been regarded as passing the limits of fair comment. At length, however, the reformers have had their way; and henceforward the Association will accept no more banquets. The members are to be warmly congratulated upon having taken this step towards an honourable independence upon the recommendation of President M'Millin. Mr. John P. Harbison is the President for the coming year; and if he determines to signalize his term of office by energetically following up this initiative, he will be one of the most truly distinguished leaders that the Associated Gas Managers of the United States have ever had.

Electric Lighting in Central London.

IT has never been the policy of the JOURNAL to deny that companies supplying electric lighting in a reliable fashion for business and domestic uses in wealthy neighbourhoods may obtain a good deal of business. Whether or not they pay a dividend must, of course, greatly depend upon their own management. We are impelled to make mention of this subject here this week by the recent holding of a general meeting of the shareholders of the Metropolitan Electric Supply Company, at which a good deal was said as to the extent to which electric lighting is being taken up in certain parts of London. The Company have two central stations actually in full working—one in Whitehall and the other in Sardinia Street, Lincoln's Inn Fields. The latter is the larger. With reference to the work of these stations, the Chairman of the Company (Sir John Pender) told the shareholders the other day that they supply current "equal to about one-third of the total number "of lights supplied in London by public companies." This statement would be very misleading if it were read to mean any other but electric light companies. The statement was further made that the Company are actually supplying "current for 40,000 lights, to 300 customers." The wording of this announcement is somewhat peculiar. It is not guaranteed that 40,000 lamps are really lighted, but only that sufficient current for them is being distributed, which may not mean the same thing. However, be this as it may, it follows that the average number of lights supplied per consumer is upwards of 133, which bears out our contention as to the grade of consumers that such a company must depend upon. It certainly seems a great deal to claim—a consumption amounting to 40,000 lamps within about two years from starting business; but a very few theatres and hotels will swell the total of an electric lighting company's rental. It is of the nature of such a business to skim the cream of its possible trade at once; but after that the growth of the undertaking is slow. The rate of charge by the Metropolitan Company for current supplied by meter is 7½d. per Board of Trade unit, or a fixed annual rent per lamp may be arranged. For example, the charge for a nominal 8-candle power lamp for three hours per day is £1 a year. A single lamp of this grade is, however, of little use to anybody accustomed to anything brighter than a candle; and in accepting the latter as their standard of comparison instead of the ordinary gas-burner, the Metropolitan Company make a clear confession of weakness. Moreover, before the real expense of the light in their case can be ascertained, there are several extras to be reckoned. Thus the rent of a transformer is £10 a year for 50 lamps and under; the rent of a main switch is 7s. 6d.; and of a small meter, £1 per annum. Besides this, there is the cost of the renewal of lamps, which the consumer has to pay. The Company admit that their extras run the cost of current up to 8d. per unit, which is equivalent to gas at 8s. 8d. per 1000 cubic feet. How much trade they are going to do at this figure, after they have taken the cream off their district, remains to be seen. We, at any rate, do not expect that their first rush will be maintained.

Protection Abroad and at Home.

ALL the newspapers of the United Kingdom have concentrated their wisdom on the recent plunge of the United States Government into Protection of a character to which all that has hitherto borne the name in any country is "as moonlight unto sunlight—as water unto wine." M'Kinleyism and its effects have given many people on this side of the Atlantic something to think over, and even, in the pride of their Cobdenism, something at which to point the finger of scorn. When the new tariff was under discussion and arrangement by the United States Legislature, although it was much debated at home and abroad, very few even of those most nearly concerned seemed to realize what would ensue upon its enactment. The citizens of the United States, as a whole, had been so saturated with teachings which persuaded them that every bit of the material advantages in which they flatter themselves they surpass the pauper subjects of the effete monarchies of the Old World, was due to Protection, that it was natural for them to believe that any increase of the tariff must do them more good. This conclusion is the only natural one for those who fully accept Protectionist doctrines. If a certain amount of protective taxation upon imports does everybody in the country so much good, increased taxation must improve this already satisfactory state of things. The details of the M'Kinley tariff scheme are said to have been arranged with the object of repaying such groups of capitalists and manufacturers as most liberally supported the winners in the last Presidential campaign. This is very likely true; but the point to which we desire to draw attention is that such a plot would not have been possible if the whole community upon which it was imposed had not been willing beforehand to try almost any experiment in the way of Protection. The country was assured that everybody would benefit by the readjustment of the tariff; and accordingly the tariff was readjusted. No sooner was this done, however, than the public found out that they had been shamefully imposed upon. Up went the price of every marketable commodity; whereupon it became clear to the meanest capacity that the sacred name of Protection had been used to cover a measure of law which robbed the many for the benefit of the few. Thereupon the great American public uprose in wrath, and drove almost into extinction the Party that had done this wrong to its convictions.

Wherefore the consistent Cobdenite on this side, with not a little of that Pharisaism which is one of the least lovely traits in the British character, jeers at the poor deluded Yankees for not understanding that the burden of Protective duties falls always and inevitably upon the consumer. "Thank Cobden, Bright, and Mill," says the consistent British Freetrader, "I am not as those unfortunates yonder;" and then, if he is a Manchester or a Birmingham man, he proceeds to reflect how nice it is that so large a share of the local rates are borne by the gas consumer without feeling it. If he is a Londoner, he will be heard abusing the County Council for foolishly throwing away the revenue derived from the Coal Dues, which he is perfectly sure were imperceptible by the consumers of coal, and the removal of which, as the *St. James's Review* puts it, conferred "not one farthing's worth of advantage upon any inhabitant of London except the dealers in coal."

How reasonable is all this, to be sure! But then, as most acute observers of human nature well understand, a man's own besetting sins and errors are just those which disgust him most when indulged in by others to his detriment. The M'Kinley tariff readjustment may be despicable as a corrupt bribe; but, in principle, there is no reason why a Protectionist people should object to it. Of course, those who suffer from it do not like it; but this feeling does not imply that they dislike Protection in itself, but only that they want a Protection that benefits them as well as other people. If Mr. M'Kinley could only have devised a tariff that immediately benefited everybody, he would have been by this time the most popular instead of the best-abused politician in the United States. He and his friends say, in fact, that everybody will be benefited in due time, because after a while wages will rise to the level of values created by the new scale of taxes on manufactured articles. It is to be feared, however, that this promise is only a sop to the wage-earning voter; for it is obvious that unless Mr. M'Kinley can, by enactment, enlarge the size of the dollar, the people who have to live upon an inelastic number of such pieces of solid coin will henceforth be able to buy less with them than they could heretofore. Free Trade is good, as Britons profess to believe; and we are not prepared to argue that Protection cannot under any circumstances be beneficial. What we do, however, contend for is honesty in those who pretend to hold either doctrine. It is impossible to respect a nominal Freetrader who preaches Cobdenism when he wants to send his cottons free into another country, yet hankers after an indirect tax on a necessary of life at home because it happens to suit his own convenience. Similarly he is an unworthy Protectionist who wants to make everybody pay duties except himself. Now, Free Trade is easy to understand and apply with perfect fairness, when once the great fundamental idea of allowing "every tub to stand on its own bottom" is grasped. Until a man does this, he is no Freetrader, although he may be an Alderman of Manchester or even of Birmingham. Having grasped it, he has a claim to rank as a Freetrader indeed; and his notions of taxation will be beyond reproach from the Freetrading point of view. He will not puzzle himself over plans for making Smith pay some of Brown's rates, in order that Brown may afford to buy things of Smith. The Protectionist, on the other hand, must, if honest, admit that "what is sauce for the goose is sauce for the gander;" and he will not be able to rest until he has "protected" all classes in the community. This is impossible so long as gold remains the standard of value for all the world.

Presentation to Mr. W. E. Roberts, of Blackburn.—Last Thursday evening, Mr. W. E. Roberts, a clerk in the Gas Department of the Blackburn Corporation, was presented by the officials with a timepiece, as a token of their respect and esteem, on his leaving Blackburn to take an appointment at Eastbourne. The presentation was made by the Gas Engineer (Mr. S. R. Ogden).

The New Gas-Works of the Rawmarsh Local Board.—In our notice last week of the proceedings at the opening of the new gas-works which have just been completed for the Rawmarsh Local Board, from the plans of Mr. T. Newbigging, C.E., of Manchester, we should have stated that the Manager is Mr. Edwin O. Watson, who received his appointment about a month since. Mr. Watson was trained under his father, who was for many years Superintendent of the Neepsend station of the Sheffield Gas Company; and before going to Rawmarsh, he was at Swansea. We may mention, in connection with these works, that the large scrubber, and the tar, liquor, and water pumps, were made and erected by Messrs. R. Dempster and Sons, Limited, of Elland.

WATER AND SANITARY AFFAIRS.

The address delivered at the half-yearly meeting of the West Middlesex Water Company last week, by the Chairman, Sir W. H. Wyatt, put the case of the Metropolitan Water Companies in general, as well as that of his own Company in particular, in a very clear and temperate manner. The description given of the attitude of the Companies towards the City Corporation and the London County Council, agrees with the statements we have already made to our readers, subject to the addition of certain details. That the Companies had good reason for their absence from the Corporation inquiry, has been very distinctly shown; but there is a ready admission on their part that the County Council occupy a somewhat higher position in this matter than the Corporation—Parliament having authorized the Council to expend £5000 in conducting an inquiry, whereas the Corporation simply proceeded at their own instance. At the same time Sir W. H. Wyatt signifies that the Companies feel they would not be justified in naming a price for their undertakings to a body which has not the slightest power to buy. If the Council will be sufficiently frank to name a price, the Companies are prepared to give the offer, in its provisional character, their careful consideration. With all this, the Companies have no desire to sell; and the shareholders in the West Middlesex have obviously no reason to wish that their property should change hands. They are receiving dividends at the rate of 10 per cent.; and—as we intimated last week—their undertaking is in such a flourishing condition that they are going to give the consumers a rebate of 7½ per cent., in place of the 5 per cent. granted during the last three years. The gift will be equal to £17,000 per annum; and if the consumers are wise, they will not be disposed to throw this away for the sake of the honour and glory of being served by the County Council or a representative Water Trust. Even the parish authorities, speaking, of London at large, have reason to be satisfied with the present system; seeing that the eight Metropolitan Companies paid last year a total of £156,000 for rates and taxes, exclusive of income-tax—the West Middlesex Company contributing more than £18,000. By far the greater portion of this formidable total went into the local exchequer; and the amount is destined to increase under the new assessment, although, in the case of the West Middlesex Company, the quinquennial valuation, in relation to the water-rates, will add nothing to the dividends of the shareholders. Any increase in the profits of this Company will revert to the consumers in the form of rebate. That the revenue of the Company will rise is inevitable, owing to the substitution of larger houses, and an increase in the number of dwellings. In the midst of these changes, the interests of the public are promoted by the wise resolution of the West Middlesex Directors to expend their capital for the next five years—if they are allowed to continue so long—only on pipes for new districts. After that they will have to seek parliamentary power to raise further capital. Certainly we may venture to say that the financial position of the West Middlesex Company is a happier one than that of the London County Council, "piling up debt," as Sir W. H. Wyatt observes, and increasing the rates.

The policy of the London County Council, in seeking to induce the Companies to name a price for their undertakings, has a reason which is sufficiently evident. Whatever price the Companies might name would at once establish a maximum, and would be put in contrast with some scheme for a new supply. Even if the principle of arbitration be introduced, the Companies cannot accept it. The fair value of the undertakings can be readily ascertained; and there is no need to ask a Board of Arbitrators to fix the amount. The accounts of the London Water Companies are examined and certified by a Government Auditor, and are open to the world. The County Council have all the data before them, and can name a proper price as readily as anybody else. But there is an obvious desire to set aside the subject of income, and to rest the question on some other basis. The attention of the public is not called to the purchase of profits, but to the buying of certain works, declared to be partly obsolete and dependent on a supply neither sufficient in quantity nor good enough in quality. Yet we venture to predict that if the County Council by any means get possession

of the water supply as now administered by the Companies, the history of the controversy will soon come to a close. The income from the water supply will be appropriated in aid of expenditure for other purposes, and very little more will be said about laying a pipe from Wales or Devonshire. If the County Council possessed the powers enjoyed by the Corporation, there would be a tremendous onslaught on the Companies in the next session of Parliament. As it is, only let some Bill or other, relative to the water supply of London, get into Parliament, and the County Council may be expected to put in an appearance, and in so doing will make the most of the opportunity. The Vestries are clubbing their subscriptions together to furnish funds for launching the Bill which is to transfer the supply to the Council, or to some kind of Water Trust. The scheme of a Water Trust is not popular at Spring Gardens, and can be easily abandoned; but its presence serves a purpose. The Vestries are thus playing the part of the mouse nibbling at the cable by which the lion is bound. Let the cable be cut, and the lion will speedily be in the field. But there is also the ancient power that rules the City; and in that quarter a representative Water Trust will find an advocate. The Corporation will doubtless bring in a Water Bill, and then the County Council can appear before the Committee to whom it is referred. But, in all probability, when the parties meet there will be a fight; whereas the Vestry Bill, if it can be brought into Parliament, will be virtually supported by the Council, although it will encounter the opposition of the City. Amid these complications, unless the Government interfere with a strong hand, any change in the administration of the London Water Supply is likely to be a remote event. If the Corporation and the Water Companies are strong enough to thwart the County Council, and the Council and the Companies prove sufficiently powerful to crush the scheme of a Water Trust, nothing short of interposition on the part of the Government will suffice to effect a speedy transfer of the water supply. As it is the unexpected that generally happens, perhaps some surprise awaits us. The shortest way out of the dilemma is for the Companies to be guaranteed a proper price, let the transfer be to whom it may.

The New Lord Mayor (Mr. Alderman J. Savory), who is a Director of the New River Company, enters upon the duties of his office at an eventful period in the history of the Metropolitan Water Supply. It will be a curious circumstance if, during his mayoralty, some definite step should be taken by the Corporation in the direction of transferring the water undertakings to some public authority.

The Gas Question in Paris.—According to the latest French gas publications to hand, a provisional agreement has been signed by M. Camus, on the part of the Paris Gas Company, and M. Alphand, representing the municipal authorities, for a reduction in the price of gas from 30c. to 25c. per cubic metre for lighting, and to 20c. per cubic metre for heating purposes, as from January next. In return, the Company are to have their concession extended by 25 years—viz., to Dec. 31, 1930. There are in the agreement several important clauses affecting both parties thereto, into which we cannot now enter. The scheme will, of course, have to be approved by the shareholders of the Company, as well as by the Municipality and the Government, before it can come into operation.

The Production of Coal in India.—According to a recent Indian statistical statement, the production of coal in all India last year was 2,045,359 tons. Of this Bengal gave 1,641,354 tons; the Central provinces, 144,465 tons; Assam, 116,676 tons; and the Nizam's territory, 59,646 tons. In 1880 the total production was 1,019,793 tons, almost wholly in Bengal; in 1883, it was 1,315,976 tons; in 1886, 1,388,487 tons; and in 1888, 1,708,848 tons. In 1880 the only sources of supply were Bengal and the Central Provinces. The latter yielded 31,928 tons in that year, against 144,465 tons in 1889. The Assam coal-fields were first worked in 1884, when they gave 16,493 tons, and 116,676 tons in 1889. The Central Indian coal measures were also operated for the first time in 1884; the production being 2100 tons, against 52,956 tons last year. Coal was first worked in the Punjab in 1887; and last year the yield in that province was 22,835 tons. The Central Indian coal-field was opened up in 1885, and in 1889 it yielded 56,956 tons; while the Nizam's territory, which gave only 3259 tons in 1887, gave 59,646 tons last year. On the whole, during the last decade the coal production of India doubled. At the commencement of that period, the only fields worked were those of Bengal and the Central Provinces; at the end there were in addition mines in four other provinces and territories. In Bengal the yield increased from 988,565 to 1,641,354 tons; and in the Central Provinces, it increased nearly five-fold.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1009.)

THE past week opened fairly in the Stock Exchange, and a more hopeful feeling prevailed for some days that matters were slowly but surely improving. This promising start, however, received a rough check, owing chiefly to operations in New York. With this came a run upon the Bank of England for gold; and on Friday, the Directors had to put their rate up to 6 per cent. This move was probably quite unavoidable; but coming just at this time, it is most unfortunate. The difficulties of the next settlement, looming in the very close future, threaten to be quite sufficient without the extra turn of the screw caused by a higher rate. It is almost superfluous to say that prices generally have had a fresh fall, and that the week closed very gloomily. Perhaps the best that can be hoped for at present is that a 6 per cent. rate may be efficacious; and that a further rise may not be necessary. The Gas Market, meanwhile, has again exhibited its exemption from influences which affect most markets. One or two stocks have, for special reasons, slightly receded; but the chief issues have actually effected small advances, and the rest remain steady. Gaslight "A" has been at good steady prices throughout the week; the closing figures being the best, and the quotation showing a recovery of 1, which it had dropped the week before. The secured issues have not been so firm; the 6 per cent. debenture receding 1½, and some 10 per cent. preference being specially done as low as 246½. South Metropolitans continue extremely quiet. What few transactions were effected, however, realized good prices, especially for "A." Commercial old made another small advance of 1; but no business has been done either in it or in the new. The Suburban and Provincial undertakings continue almost unnoticed; and beyond one or two deals in British, nothing has been done. Of the Foreign companies, a good deal has been done in Imperial Continental at about 222; the nominal quotation being 1 better. The quotations of Continental Union and European are slightly modified. Of the South American group, Buenos Ayres has receded ½. This Company will pay a 6 per cent. interim dividend. Monte Video and San Paulo are steady. All the rest offer no particular feature. Water stocks have been quite active on some days, and wholly unnoticed on others. Prices of all operated in are steady and unchanged.

The daily operations were: Moderate business in Gas on Monday, with general firmness. The only move was a rise of 1 in Imperial Continental. Activity in Water, with the same general characteristic. Tuesday was rather quieter, and prices of Gas stocks were not remarkable. Water was not touched. Wednesday's business was almost confined to Gaslight "A" and Imperial Continental, which were considerably dealt in. Gaslight "A" and Commercial old rose 1 each. Several Water stocks changed hands at good average prices. Thursday was a quiet day; but prices kept up well. Friday was much the same; and prices were good, except for Gaslight 10 per cent. Business done on Saturday was marked at good figures. Of the untouched issues, however, Gaslight 6 per cent. debenture fell 1½; and Buenos Ayres, ½.

ELECTRIC LIGHTING MEMORANDA.

The Commencement of the St. Pancras Electric Lighting Undertaking—The City and South London Tramway—Croydon Ventures upon an Application for a Provisional Order.

THE principal topic of discussion for the past week in regard to electric lighting has been the formal commencement of the St. Pancras Parish electric lighting undertaking, as signified by the laying of the foundation stone of the principal central station. Seeing that the Vestry was formally committed to this speculation some two months ago, as noticed in the JOURNAL at the time, the mere fact that the central station has begun to take an objective existence is not a very startling event, although it seems to be regarded as such by the London daily newspapers, which have nearly all commented upon it in a manner that would be distinctly more interesting if their lucubrations were not so obviously late. Our readers already know all the leading features of this St. Pancras experiment, which was largely copied from the earlier St. James's scheme, and is nowise remarkable for anything except the question which it suggests—whether it will pay. The *Standard's* comment on the business, is perhaps the most noticeable one; and even this somewhat ponderous criticism of the action of the Vestry would have been more useful while the policy of committing the ratepayers to such a venture was being considered, than it can be now that the responsibility has been accepted by the Vestry for good or evil. It is likely to be both amusing and irritating to the well-meaning Vestrymen who have had to settle the question according to their lights, without the slighest outside assistance, to read in the newspapers these calmly superior remarks upon the political, economical, and social aspects of their undertaking. The writers for the newspaper press, of course, know more about everything than anybody else; but it must be confessed that in too many instances their omniscience is apt to be uttered rather late in the day. Now, we have from the first entertained and expressed but one opinion concerning

this St. Pancras electric lighting scheme. Technically, it is probably as well-devised a plan as any that has come before the public. The Vestry deserve credit for having recognized the necessity of good professional advice, and for having taken it in a dignified manner. All the same, the question remains as to the expediency of undertakings like this by a local authority; and, in particular, as to the desirability of anything of the kind for St. Pancras. On the general question, we hold that electric lighting is not proved to be such a necessary of life that public funds should be engaged in providing it; and, on the special question, that the parish of St. Pancras is not so well adapted for ensuring the commercial success of a venture of the kind that the general objection can be overruled in its case. Time will show who is right in this matter.

Next to the St. Pancras experiment, electricians and the public have had their attention absorbed during the past few days by the formal opening of the City and South London subterranean tramway line, which is to be worked by electricity. We have already noticed this remarkable engineering work; and it is therefore only necessary to deal with those features of the traffic arrangements which came into prominence in connection with the opening. It was originally intended that the line should be worked by wire-rope traction; but during its construction the engineers became converted to electrical haulage. We have expressed the opinion that if electric locomotion is possible anywhere, it must be upon this line, where the atmospheric conditions are practically constant, and where nothing interferes with the placing of the electrical conductors. For, of course, there is no attempt to drive the tramcars by storeage batteries. This is evidently not regarded as possible, notwithstanding all that those interested in the accumulator business have essayed to prove to the contrary. The power required to move the train of cars is generated at one end of the line, whence it is conveyed, in the form of electricity, along the whole length of the way by means of conductors; and the electro-motors on the train take it from these by a rubbing contact. The same means serve to light the cars. It is not for us to question the authority of the gentlemen who have decided upon the adoption of this particular method for the transmission of energy; but the accounts of the equipment of the generating station give one the impression that an enormous superfluity of steam power has been deemed to be necessary beyond what would have been sufficient if rope haulage had been adhered to. A great parade of the arrangements was naturally made on the opening day. Directors, guests, and everybody else belauded the perfection of everything about the line; but those who are familiar with the inaugurations of electrical undertakings are not particularly impressed with assurances of this kind. An unkind Fate interfered with the completeness of the proceedings, however, by introducing a break-down, which was, of course, explained by reference to some incidental point. But the fact remains that, although the outward journey from the Monument to Stockwell was safely performed, the guests had to return to the City by omnibus. One can imagine how annoying anything of this kind is to those interested; and we do not desire to attach undue importance to the incident. Nevertheless, it shows that electrical traction is not yet wholly trustworthy.

As will be seen by the report in another column, Mr. W. H. Preece has persuaded the Croydon Town Council to apply for a Provisional Order for electric lighting. Croydon is a young Municipality that has so far developed the capacity for incurring debt more than any other of the attributes of a reformed local authority; and this latest enterprise is calculated to embroil it more deeply with money-lenders, whatever else it may do. The district is so scattered that Mr. Preece had some reason for recommending the high-pressure alternating transformer system of supply; and has been audacious enough to tell the Croydon people that electric light is as cheap to supply as gas, in proof of which he recommends them to begin by charging 7d. per unit, which is equivalent to gas at 7s. 6d. per 1000 cubic feet. Moreover, he contemplates running some of the distributing wires overhead, to save expense, as to which the Board of Trade may be expected to have something to say. Nobody seems to have asked the great electrician any unkind questions about the Brighton brewer; and so his overhead scheme passed —far over the heads, in another sense, of the majority of those who approved of it. Mr. Preece will get his fee; but the Croydon Corporation will learn something more about electric lighting before they have done with it.

Mr. J. H. Silcox, Manager of the Pembroke Gas-Works, has been chosen by the ratepayers of the Pater ward in that borough as one of their representatives in the Town Council.

Society of Arts.—The first meeting of the 137th session of this Society will be held on the 19th inst., when the opening address will be delivered by Sir R. E. Webster, Q.C., M.P., the Chairman of the Council. There will be four ordinary meetings of the Society before Christmas, at one of which (that held on the 10th prox.) Mr. F. Bailey will read a paper on "Electric Lighting Progress in London." There will be five courses of Cantor Lectures during the session. The first, consisting of five lectures, will be given by Professor Vivian B. Lewes, F.I.C., F.C.S., on the evenings of the 25th inst. and the first four Mondays in December; his subject being "Gaseous Illuminants."

THE IMPERFECTION OF GAS HEATING STOVES.

It would be a pity if the highly suggestive paper on the "Unburned Gases contained in the Flue Gases from Gas-Stoves and Different Burners," read before Section B of the British Association by Mr. William Thomson, F.C.S., of Manchester, should be lost sight of by gas chemists. An abstract of the paper and of the discussion upon it, giving all the salient points, has appeared in the JOURNAL (*ante*, p. 602); but the full text of the paper is given to-day in another column. For the purpose of this article reference will be made both to the text of the paper and the reported discussion.

It is impossible to read Mr. Thomson's account of his experiments without agreeing with Dr. Jacob's remark that these "were somewhat imperfect, and might very profitably be continued further." We say this not with any wish to disparage the experiments themselves or the results obtained from them. Mr. Thomson is an able analyst, whose care and conscientiousness in the conduct of experiments do not require to be certified by us. At the same time his industry is such that he needs no impetus to undertaking any special research that strikes him as likely to prove interesting or profitable to science. Nevertheless, Mr. Thomson's time is not all his own, to bestow upon a course of experiment that does not appear likely to lead to any immediate practical result. He has his business to attend to, and this does not consist in discovering the imperfections of gas burners and stoves, to which work he can consequently devote only such time and energy as can be spared from his ordinary avocations. Moreover, this particular task is very thankless, and necessarily unremunerative—besides being, as Mr. Thomson confesses, both difficult and troublesome. People who make gas burners and stoves to sell, and accordingly advertise them far and wide, will not feel grateful to Mr. Thomson or anybody else who volunteers to tell the world what imperfect appliances these really are. If there was any real good in the exhibition award system, this description of criticism would be undertaken in the public interest before prize medals were bestowed upon exhibitors for the "merit," or "excellence" of their wares. As it is, however, prize medals are awarded more for the attractiveness of exhibition stands than for the degree in which the wares exhibited merit the claims advanced for them by the maker. There is nobody to tell the public whether advertised goods are as represented by those interested in their sale; and we should be very loath to say that the unsupported word of the seller could be taken with greater confidence with regard to gas-consuming appliances than in reference to any other commodity. There is, of course, the rough-and-ready test of the market, which rejects in the end commodities betraying too great a discrepancy between their intrinsic and their advertised value; but it is notorious that many articles which have the largest sale of their class, do not owe this vogue to their own superior excellence but to the superior commercial adroitness of their maker. It is the same with specialities as it is with retail trading in general. If one draper, or one general dealer, is seen to add shop to shop while his fellows stand still, it is not to be inferred that his goods are better than theirs, but merely that he is a better man of business.

At the same time, the foregoing consideration sadly interferes with the competition of commodities on their own merits. Gas burners and stoves, although they have their aspect as scientific appliances, are also articles of trade; and the impartial man of science who essays to investigate them in the former light runs a risk of stirring up a hornet's nest of commercial interests. Mr. Thomson's analysis of the results of burning coal gas in stoves and illuminating burners, is precisely that class of critical work which is likely to bring trouble from the traders; and the more comprehensive and complete the work, the more trouble it is liable to make. For the same reason, it is work that is eminently useful to the public and valuable to science; and we are very sorry that there is no competent authority, with funds enough and interest enough in the matter, to employ Mr. Thomson to complete the work he has so well begun.

It appears that Mr. Thomson set out with the idea of ascertaining if, and to what amount, ordinary gas burners and stoves in common use allow carbonic oxide to escape as one of the products of combustion. This is a very easy, and it may be said natural, question for a chemist to ask himself with regard to a gas-burner; but Mr. Thomson confesses that the investigation necessary to answer it has proved for the time beyond his means to carry on—an admission not surprising in the circumstances. Failing this, Mr. Thomson turned his attention to the easier task of ascertaining whether carbon and hydrogen escape unburnt from gas stoves and burners under ordinary conditions of usage; and, if so, in what quantities. Although less difficult than tracing carbonic oxide, this task is not one to be essayed by a tyro; and Mr. Thomson deserves great credit for undertaking so much tedious work as must have been involved in it—purely, as would appear, for the sake of obtaining knowledge. His results, so far as they go, are more than slightly astonishing to those who have been too ready to believe without question that a popular form of gas-stove is necessarily a good form. He states, in so many words, that "the general results were conclusive in showing that the combustion of gas, when

burnt in gas-stoves for heating purposes, is much more incomplete than one might be led to suppose."

Beginning, by way of example of good burning, with an Argand burner, Mr. Thomson found that it consumed all the carbon, but passed a little hydrogen unconsumed in one experiment; while in another experiment, which we gather was with gas at higher pressure, both carbon and hydrogen were passed unconsumed. Here it may be as well to interpose the remark that the words "Argand burner" convey no exact meaning to a gas engineer. Mr. Thomson does not say what description or make of burner he used; nor was the pressure of the gas registered in connection with any experiment. This is an omission which would be more serious than it is if Mr. Thomson had been testing burners as such, and not endeavouring only to ascertain what happens when gas is burnt in the ordinary way by a consumer, to whom one burner is as good as another. In order to escape from appearing to treat Mr. Thomson's experiments as a comparison of one burner or stove with another, we shall refrain from referring to any of them by the maker's name, and shall discuss the apparatus employed as in every example a mere type of its kind.

It is found that a flat-flame gas-burner, as lit for illuminating purposes in the open air, passed a hundred times as much unburnt carbon as the Argand; but only one-third as much hydrogen. There is an obvious connection between the more complete consumption of carbon and the better illuminating power in the case of the Argand. The better consumption of hydrogen in the case of the open flame calls for explanation. The incandescent gas-light passed more carbon than the open flame, and more hydrogen than the Argand. Unfortunately, Mr. Thomson's resources do not appear to have included a regenerative lamp of any kind.

One scarcely knows what to make of the results with a gas heating stove using luminous flames of the ordinary type. In the first experiment, when the consumption of gas was small—too small to be of much use in warming a room, seeing that it hardly exceeded that of a good lighting burner—the proportion of unburnt carbon and hydrogen passed by the "stove," did not differ much from that found for an open lighting burner. As the consumption of gas increased, however, the efficiency of the burning diminished, until the proportions of carbon and hydrogen passing unburnt attained remarkable figures. This result seems to show at least that putting flat-flame burners into a "stove," where the supply of air is limited, does not improve their efficiency.

Then we come to the class of gas heating stoves with atmospheric burners playing directly upon solid refractory materials. Here, in a stove passing 6·81 cubic feet of gas per hour, and burning gas in contact with iron, 66·3 parts of carbon and 20 parts of hydrogen escaped unburnt per 1000 parts of completely burnt carbon. Similarly, where a row of Bunsen burners were made to play on asbestos fibre projecting from a fireclay back—the type is very common—with a consumption of 8·14 cubic feet of gas, 138·9 and 11·7 parts respectively of carbon and hydrogen per 1000 parts of completely burnt carbon were found. Again, the last kind of stove tried was one of the hot-air condensing type, which was worst of all—passing upwards of 200 parts of carbon per 1000 parts of carbon completely burnt. This is a serious matter, especially as nobody knows for certain in what form the unburnt carbon of these combustion gases exists. Some of it, in the worst cases, probably enters into the production of that evil odour which is given off by some gas-stoves. We cannot think that any noteworthy proportion occurs as carbonic oxide, or the effects upon human life would have been more conspicuous than has hitherto been the case. It is greatly to be wished that Mr. Thomson could amplify his researches, and settle this mystery.

As to the incomplete combustion that follows when gas-flames (atmospheric or otherwise) are made to impinge directly upon a solid surface before the flames have completed the internal work of combination, there have not been two opinions among capable pyrologists. Mr. Frederick Siemens's discovery of the importance of permitting a flame to burn itself out before attempting to utilize its heating powers otherwise than by radiation, has never been shaken. Several varieties of gas heating stoves on this principle have been made; and it is regrettable that Mr. Thomson had none available. What he had were of course of the type in most general use; but it does not follow from this fact, as we have already remarked, that the type is the best. On the other hand, it is quite possible that a better type may labour under other disadvantages, such as costliness, delicacy, or (worse than all) want of business ability on the part of those interested in it. If a gas heating stove is to be regarded purely as a scientific appliance, it is evident that one of the first requirements should be that it should burn its full supply of gas completely, innocuously, and inoffensively. Without going any further, we may be sure that no burner which violates the accepted theory of flames, by cooling down its blazing gas by contact with a solid body, can satisfy this initial requirement. Illuminating burner makers seem to have fairly realized this law; but we appear to be yet a long way from witnessing similar recognition of physical laws in the manufacture of heating stoves. How to make these look pretty and sell cheap, is the aim of the most successful makers. It is high time, for the credit of modern domestic gas engineering, that somebody like Mr. Thomson arose to call the attention of makers and the gas managers who exercise a sort of supervision over gas heating stoves, to the imperfections of the popular forms of these appliances. Unfortunately we are not informed by equal authority of the existence of anything better.

A NEGLECTED DEPARTMENT OF GAS CONSUMPTION.

No one who has watched the progress of artificial lighting can have failed to notice the marked increase in the demands upon this agent by shopkeepers, not only for its own special purpose, but also as a means of advertising. The absolute necessity of having sufficient light to clearly illuminate the contents of a shop, and, beyond this, the attractive nature of a brilliantly lighted establishment, have been generally recognized ever since the sale of gas at moderate prices rendered the evening hours as busy as those of the day. But lately there has been a tendency to go still further in the way of seeking to "draw" the public by some special display of artificial lighting. This may take the form of employing a greater number of gas-burners than are really necessary. Rows of gas-brackets, arranged at short intervals apart, are common objects in large shop-windows. Sometimes the respective occupiers of several adjoining shops will combine, and erect a number of large gas-lamps on the edge of the pavement. Or the attraction may consist of a line of gas-jets placed at or near the level of the top of the window, or large lights, ranging from 20 up to 500 candle power, disposed on the exterior of the premises. The line of gas-jets may be elaborated into devices of various kinds; the name of the proprietor being the most common. And some will even go to the expense of designs in "crystal" and "transparencies."

All this indicates that the public are attracted, like moths, by a brilliant light; and that, provided the available agents are efficient and not too costly in price, the supply of light for one or two purposes is likely to prove an important and remunerative branch of business. It is especially in this department that gas has suffered from the competition of oil and electricity. The quotations to an extent larger than is due to the fact slightly modified. Of the novelties, or that they are cheaper and has receded ½. The coal gas. Something may be allowed on the dividend. Very; but, after all, it is not the new agent, but the light, that the shopkeeper wants. So long as he produces the desired effect, he does not trouble whether it is attained by the medium of gas, oil, or electricity. But the fact is that, in the first place, oil-lamps and electric lights have been pushed or brought before the notice of tradesmen, whereas it is a most unusual thing for anyone to solicit the use of gas, either for advertising or any other purpose. If the shopkeeper wants a gas device, he has to send for a gas-fitter, and very likely to practically arrange himself the carrying out of the whole affair. But the agents for the oil-lamp makers or the electric lighting company come along, and ask for orders, and guarantee to put the whole thing up without further trouble, so far as the user is concerned. Very likely, too, they will be prepared to arrange to keep the light in order. If the consumer is willing to pay a good price, and is fortunate enough to meet with a competent fitter, the high-power gas-lamps and other appliances will be thoroughly efficient in their operation. But very often we see gas devices that are not satisfactory. They flare away two or three times as much gas as is really required, are uneven and ragged in regard to the appearance of the flames, or are attended by the disagreeable smell of escaping or of imperfectly consumed gas. They have not been specially designed with a view to economy and efficiency.

Now, it must be remembered that all these have to compete with appliances which have been carefully and skilfully designed, with every modern improvement, to yield a maximum of light at a minimum of expense. The oil-lamp is not a hap-hazard combination of wick-tube and oil-reservoir; nor is the electric light a promiscuous arrangement of carbons. These lamps have been designed by persons who are not merely metal workers, but possessed of a practical knowledge on the subject of the combustion of oil, or the utilization of electricity, as the case may be. It behoves those who are interested in the sale of gas to see that their speciality is not placed at a disadvantage as compared with its competitors. The selection of a certain kind of light as a means of advertising not only directs attention to the establishment of the consumer, but also to the light itself. Electricians especially are aware of this fact; and therefore we repeatedly find that they are prepared to supply the lighting of streets, places of business, and any public locality where a number of people are likely to pass, or to assemble, on terms which afford little, if any, profit on the transaction. They consider the advantage likely to follow the advertisement of the light that is thus afforded as an item when fixing on the price at which they are prepared to supply.

If it pays electricians and others who are looking to prospective rather than to actually existing custom to advertise their commodities by this means, surely it would be worth while for gas companies, with their tangible and comparatively secure area of business, to resort to it—not so much with the view of extending their trade among those who do not at present use gas, but in order to keep that which they actually have. Yet it is to be feared that many persons who would gladly resort to the use of gas as a means of attracting the public, are

driven over to oil and electricity by the fact that the sellers of gas do not concern themselves with the methods by which it is employed, and the difficulty of meeting with gas-fitters who will carry out the installation in a thoroughly efficient manner. These considerations pass without attracting much attention until the tug of competition is actually felt. Perhaps a few half-hearted efforts are made, in the way of putting up a high-power lamp here and there. But wait until active competition begins, by the introduction of electricity, cheap oil, &c.; and the matter then assumes a very different position. We must look across the Atlantic to see this state of things, and there we find several towns where coal gas has to compete with electricity, oil at about 1d. a gallon, natural gas, and perhaps all three together. Under these circumstances, the gas suppliers are found to be actively looking out for business. They afford every facility in the way of fixing gas appliances, and will undertake their supply on the best possible terms. With regard to high-power burners, they are prepared to supply them on hire, and to keep them in repair. In our own country there has lately, as our readers are aware (see *ante*, p. 903), been an example of a town where competition from electric lighting has been threatened. The result is that a scheme for letting high-power gas-burners on hire is at once introduced and actively pushed.* This scheme, which was suggested by the Gas Manager, may possibly have lain in abeyance for years. An average Board of Directors would not welcome it unless roused to do so by circumstances similar to those which led to its introduction in this case.

The suggestion we have to offer is that gas suppliers should direct their attention to this department. The use of gas cooking-stoves was very limited until the gas companies took up their introduction by letting them on hire and fixing them gratis. Yet few companies would now look with equanimity upon the loss of their "cooking" consumption. So with gas heating-stoves, gas-engines, &c. With these examples in mind, it appears desirable to direct attention to the use of high-power burners and special devices for advertising. These might be supplied on hire, kept in proper order, and lighted or extinguished at stated hours if desired. They might be supplied by contract at a fixed sum to cover everything. Then we should see the high-power burners always in proper order, adjusted so as to give the best possible effect. In place of the flaring row of jets, comprising burners of all sorts and sizes, in all stages of disruption, there would be a neat line of even, regularly-shaped flames. The result would be much more satisfactory to the consumer, who at present is frequently simply wasting gas in a reckless manner; and it could not but have the effect of putting gas in a better position before the public, by rendering it easy to point to standing examples of gas being used with economy and efficiency without flickering, smoke, or smell.

Mr. T. Hudson Beare, whose name was mentioned in a "Note" in last week's JOURNAL in reference to some tests of cement he has lately carried out, asks us to correct the statement then made that he is connected with the Liverpool University College; he being Professor of Engineering at the University College, London.

The Denver (Colorado) Water-Works.—It is stated that water will be drawn from the reservoirs formed by the great dam at Denver, referred to in the JOURNAL last week, into the pipe leading to the city, from a 4-feet cast-iron pipe placed vertically in a shaft 12 feet in diameter and 160 feet deep. This shaft will be at the north end of the dam, in solid rock. Water will be admitted from the reservoir to the shaft through tunnels 40 feet apart vertically. The immediate drainage area of the reservoirs is said to be about 6 square miles; but a 42-inch wood conduit will extend 12 miles to the north fork of the Platte River, and tap a drainage area of 2000 square miles. The conduit will have a daily capacity of 65 million gallons. Ample bye-washes will be provided; the water-level being 15 feet below the top of the embankment, where it is 90 feet in thickness.

Laying Mains round Curves.—Mr. W. H. Richards, Superintendent of the New London (Conn.) Water-Works, writing to the *Engineering and Building Record*, answers a question, put by a correspondent to the Editor of that publication, as to the maximum deflection allowable in the laying of water-pipes round curves. He says this depends on the depth of bell and joint room; but the usual practice of making all but short curves with straight pipe seems to him to be wrong, in view of the increase in friction occasioned by the projection of the spigot end on the inside of the pipe. It will be readily seen, he says, that any considerable deflection throws the spigot against the inside of the bell on one side, and out into the pipe on the other. If specials are used for all considerable changes in direction, and the pipes are laid on straight lines from special to special, a less depth of bell and smaller joint-room is possible; thereby effecting a considerable saving in weight of iron in the bell and lead in the joint; and, at least on the larger mains, he suggests this as the best practice.

* We learn from Mr. S. Bark, of Godalming, that the experiment here referred to has been in every way successful; all the principal tradesmen in the town having adopted his suggestion. Up to Saturday last 20 lamps had been fixed—producing a very good effect.

COMMUNICATED ARTICLES.

THE GADD AND MASON GASHOLDER.

A REJOINDER TO MR. W. GADD'S "REVIEW OF A CRITICISM."

By F. S. Cripps, Assoc. M. Inst. C.E.

II.

In the first part of the "Rejoinder," which appeared in the JOURNAL last week, the reviewer's attempt to prove that the vertical forces induced on opposite sides of a gasholder (represented conventionally by a square or rectangle) by the pressure of the wind, are only *half* of what they really are, was examined into. His attempted proof failed, for the following reasons:—

1. To a misapprehension and misapplication of the *triangle of forces*, wherein the triangle of forces was erroneously applied to *parallel* forces—the vertical side of the triangle being ingeniously taken as representing the vertical forces on the *two* sides of the holder *added together* (irrespective of direction); whereas it should, of course, only represent the vertical force on *one* side, and the vertical force on the other should have been obtained by resolving the diagonal force into its two rectangular components, as pointed out in the "Rejoinder" last week.

2. Also, to a singular misapprehension of the *principle of moments*, wherein the reviewer made most ingenious efforts to establish an erroneous principle—viz., that the moment of a force about any point varied according to the position of the *point of application* of the said force, although the *magnitude* of the force and its *line of direction remained unchanged*. It was argued that because the horizontal pressure of the wind acted upon the outside of the holder, to the extreme right, it did not exercise so great a turning effort over the holder as it would do if it acted immediately on the centre line down the middle of the holder (*i.e.*, at *f* instead of *e* in fig. 11). In other words, it was argued that the moment of the wind force would be doubled if applied at *f* instead of *e*.

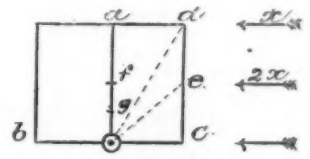


Fig. 11.

I have clearly proved the absurdity of these fallacies held by the reviewer; and in doing so it was shown to be quite immaterial *where* the centre of moments is taken to be when determining the statical equilibrium of the structure. From this the reader will see that, in order to determine the vertical reactions at the two bottom corners of the rectangle (representing the gasholder), there is no necessity for determining any particular *neutral axis* or *neutral point*. Moments may be taken around *any* point in the same plane—a mile off, if desired—it cannot alter the statical equilibrium. This is even more evident if treated by the principle of *couples*, where no centre of moments whatever is required, as the following will show:—

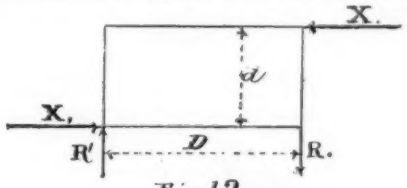


Fig 12.

Let fig. 12 be a rectangular body acted upon by the horizontal force X and the reaction X_1. These two forces form a *couple*, whose moment is equal to the product of *one* of the forces by the *arm* of the couple (*d*), and which therefore = X*d*. This couple can only be balanced by an opposite couple of *equal moment*, whose *arm* we know—viz., D (see fig. 12), and whose forces R and R_1 we want to determine. The moment of the reacting couple = RD. Therefore RD = X*d*. Now, in a *square*, D = *d*. Hence R = X not ½X as stated in the "Review." If D = 2*d*, then by similar reasoning $R = \frac{X}{2}$ *not* $\frac{X}{4}$ as the reviewer states. Therefore, whether an "axis" be assumed or whether it be not, the results are identical.

From what has been said, it will be evident to all that the "central idea" of the "Review of a Criticism" has been completely routed; and, from the attitude the reviewer assumed, it would appear almost unnecessary to refer to any other points in the "Review." But to work out the original plan of this "Rejoinder," the other points notified last week will be briefly dealt with.

The + and — Signs.

At the close of the first article of the "Review," the reviewer refers to the use he made of the + and — signs when representing graphically the effect of forces acting upon the row of upright posts. In the "Criticism," it was pointed out that the signs

were incorrectly placed to represent the *effect* of the forces; and corrected diagrams were given. The reviewer's defence is that he did not intend them to represent the *effect* of the forces on the structure, but merely the *direction* in which the *external* forces act upon the posts; and, in order to justify what he did, reference is made to Professor Hamblin Smith's book on "Elementary Trigonometry." If your readers refer, they will find that *there is not the slightest reference in any part of the book to mechanics, or to the use of the signs + and — for representing forces* —not even a hint of anything of the kind. It so happens, however, that Professor Smith has written an excellent text-book on "Statics," from the beginning to the end of which there is no use made of the signs + and — in the way referred to by the reviewer. If Professor Smith had intended the chapter in trigonometry referred to by the reviewer to have reference to mechanics, he would, without doubt, have made practical use of it when writing a treatise entirely devoted to the subject.

Of course, anyone is at liberty to use any signs in any way he pleases; but it is usual for writers on mechanics or any other subject to explain what they mean when diverting from the usual custom in these matters. The usual custom is to represent forces acting from left to right by *plus*, and those from right to left by *minus*. (For proof of this, see Weisbach, the greatest German authority on the subject.) The author of the "Review" placed the signs the reverse way—directly contrary to the above rule. Moreover, it is usual, when representing a structure *graphically*, with the signs + and — in juxtaposition with its various parts, for the signs to indicate the nature of the strains upon the parts—either tensile or compressive. In other words they do not, in ordinary use, represent the direction of the *external forces*, but the character of the *internal stress*.

Again, if in the case under consideration they merely represent the *direction of the horizontal forces* at top and bottom, they are of no service in proving that the rigid top posts (fig. 14) are four times stronger than the others (fig. 13). This is

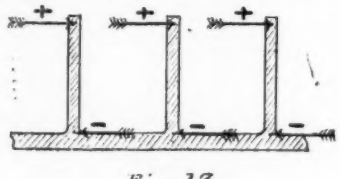


Fig. 13.

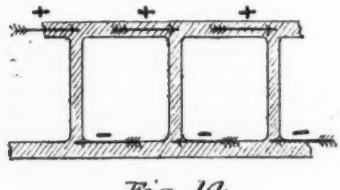


Fig. 14.

evident when we consider that the forward force at the top must be met by an equal and opposite horizontal reaction at the bottom, whether the posts be free at the top or not. So that the signs in the two sets of posts should be alike; that is, + at the top and — at the bottom in *each* set (see figs. 13 and 14). When challenged to show *how* these signs proved that one set of posts were four times stronger than the other, the reviewer wrote a remarkable letter (see JOURNAL for Sept. 2), in which he stated that the "initial force" applied at the top of the "rigid top" posts is split up into two halves—half only being left to act forward at the top as the *force*, and the other half going to the bottom to act in the opposite direction as the *reaction*. If "*action and reaction are always the same*," there must be a "slip of some kind" here, for the "initial," horizontal, forward acting force at the top, if it be (say) 10 tons, must *remain* 10 tons, and the horizontal *reaction* at the bottom in the opposite direction must likewise be 10 tons. It is an absurdity to say that the initial force of 10 tons is split up into 5 tons forward and 5 tons backwards. This is analogous to the old-fashioned absurdity that if ten men pull on a rope in one direction with a force of (say) 10 cwt. and ten men pull in the opposite direction with a force of 10 cwt., the strain on the rope is 20 cwt. This species of "chess blindness"—under different forms, it is true—appears to have possessed the writer of the "Review" all through the chapter.

Note.—In an introductory paragraph of the "Review," the following passage occurs: "The object of the present communication is to openly and frankly deal with the remarkable objections raised by the critic to the 'method' of demonstration adopted in the paper, and the results thereof; scarcely, however, with the hope that, when this is honestly done, a frank expression of the errors—which have undoubtedly been made—will be forthcoming, *for an evident, though minor error, which has twice been referred to in the correspondence raised, has not yet been in any way acknowledged except by silence.*" As this refers to my illustration of the posts when connected by a shallow and therefore flexible bar at the top, it may be as well to refer to it in this place. A satisfactory reply was given to the reviewer's reference to this matter in my letter to the JOURNAL for July 29; so that the above statement is untrue. In writing the "Rejoinder," it has been the author's desire to avoid any reference whatever to anything of a personal nature in the "Review;" but it may be stated that when the reviewer points out any error whatsoever—no matter how insignificant—in the "Criticism," it shall be frankly acknowledged. But, as yet, he has failed to do so. An ingenious *attempt* has been made to do so in the "Review," but with what result readers of the JOURNAL are now able to judge.

The Neutral Axis.

The four paragraphs in the "Review" relating to this point (see *ante*, p. 741) are perhaps the most extraordinary in the whole of the communication. It is argued that "the neutral point *cannot* be at the point *o*, for this reason, *as any text-book will tell us*, that a neutral point must be a point common to all the resultants of the component force." As already remarked, in the last article, such an absurdity as this is not to be found in any text-book in creation. As the whole argument of the passage in the "Review" is based upon this absurdity, it would scarcely appear necessary to pursue it further. It has already been shown that the determination of the vertical reactions at *c* and *d* (fig. 15) does not depend upon the exact position of any neutral axis or point. We can take moments around *any* point

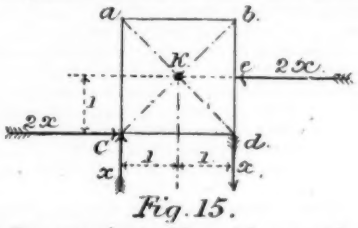


Fig. 15.

as an axis in the same plane, either at *k*, *o*, *a*, or *b*, or anywhere else, it will not alter the results. Suppose, for instance, we take moments round *k* in the square *a*, *b*, *c*, *d* (fig. 15); the only points of resistance being at *c* and *d*. The *horizontal* reaction at *c* must, of course, = 2*x* (2*x* being the upsetting force applied at *e*). Let the side of the square = 2; then, calling the vertical reactions R and R_1 respectively, we have—

$$2x \times 1 = R \times 1 + R_1 \times 1.$$

But R and R are equal $\therefore 2x = 2R$. Hence $R = x$, not $\frac{1}{2}x$, as stated in the "Review."

For the determination of the true neutral axis in complex structures, reference may be made to Humber, Du Bois, and other well-known writers, where ample justification will be found for locating the axis as in figs. 1 and 2 in the first part of the "Rejoinder," and in figs. 16 and 17 of the present article.

Pressure on Tank Guides.

This "Rejoinder" would not be complete without *proving* how far short of the mark the strains on the Gadd and Mason gasholder were represented to be in the paper read before The Gas Institute by Mr. W. Gadd. The *only* calculations given in the paper related to (1) the reactions of the tank guides upon the bottom rollers, and (2) the diagonal strain on the top curb. The method of treatment of the latter we may dismiss in the words of an American engineer, when alluding to a suggestion of the reviewer's, as "an absurdity not worthy to be mentioned." The first-named—the reactions of the tank guides—we will now consider.

For a 25-lb. wind presure uniformly distributed over the whole height of the holder, the vertical reaction of each of the rails was distinctly stated to be 1250 lbs.* (See the paragraph already quoted.) Now what is it in reality? We have for a 25-lb. wind, a total pressure of 25 × 60 × 40 = 60,000 lbs. acting over the diametrical section of the holder, which divided by 2, to allow for the cylindrical form, gives a pressure of 30,000 lbs. This may be considered as acting at a point half way up, or 20 feet above the ground. The moment of the upsetting couple acting upon the gasholder is therefore 30,000 × 20 = 600,000 foot pounds. Now, this must be resisted by the *reacting* couple of equal moment. Before we can determine the magnitude of the forces composing this reacting couple, we must determine the lever *arm*. At first sight, this might appear to be equal to the diameter of the gasholder; and it was so taken by the reviewer. But if we consider for a moment it will be apparent that we cannot take the *centres of resistance* to lifting and depression of all the resisting points (tank guides) on the two sides, as being so far apart, for the reason that the points of support are not all concentrated at the extreme diameter apart. We may determine them exactly as follows:—

Let $A A_1 A_2$ (figs. 16 and 17) represent the points of support (*i.e.*, where the rollers on the bottom curb are in contact with the tank guides), and v_1 v_2, &c., their distances from the neutral axis. Then the true distance apart of the centres of thrust and lift—viz., *c* and c_1—for neutral axis as in fig. 16 $= 2 \times \frac{v_1^2 + v_1^2 + v_2^2}{v_1 + v_1 + v_2}$, and for fig. 17 $= 2 \times \frac{v_1^2 + v_1^2 + v_2^2 + v_2^2}{v_1 + v_1 + v_2 + v_2}$

For the Northwich gasholder these distances equal 49·68 (say 50) and 45·9 (say 46) respectively. Taking the higher value, then, we have the distances of the points of resistance apart as 50 feet, which is therefore the *arm* of the *reacting couple*. Hence, 600,000 ÷ 50 = 12,000 lbs. as the vertical resistance on *each* side of the axis—*i.e.*, 12,000 lbs. pressing down on one side, and 12,000 lbs. lifting up on the other. Now, this 12,000 must be

*This 1250 lbs. was given in the paper as the result due to a 50 lb. per square foot wind pressure. But by a "slip of some kind," although 50 lbs. was given, 25 lbs. only was *intended*. We therefore accept this correction, and consider the 1250 lbs. as the effect of a 25-lb., not a 50-lb. wind.

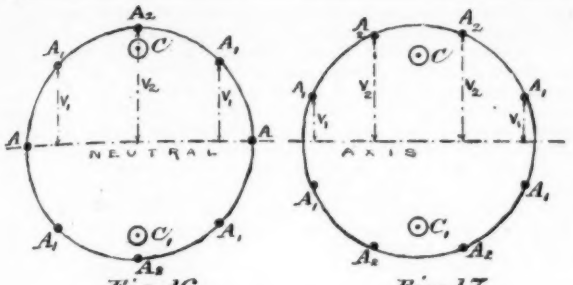


Fig 16. *Fig 17.*

distributed amongst the actual points of resistance, in exact proportion to their distance from the neutral axis, thus: Referring to fig. 16, we have for the *outer* point A_2—

$$12{,}000 \times \frac{v_2}{v_1 + v_1 + v_2} = \frac{60 \times 12{,}000}{145} = \text{say } 5000 \text{ lbs.}$$

For the two other points A_1 and A_1 on the same side of the axis we have—

$$12{,}000 \times \frac{v_1 + v_1}{v_1 + v_1 + v_2} = \frac{12{,}000 \times 85}{145} = \text{say } 7000 \text{ lbs.}$$

This divided between the two points A_1 and A_1 = 3500 lbs. *each*. To sum up, then, we have—

On A_2 and A_2 = 5000 lbs. *each*
A_1 A_1 A_1 and A_1 = 3500 ,,
A and A = 0 ,,

Note.—To prevent misunderstanding, it may be as well to mention that the lift up on one side of the axis is equal to the pressure down on the other; so that as we determined the pressure for the points on one half, we, of course, know the lifts on the other half without repeating the calculations.

For the arrangement as in fig. 17 we have for the two outer points on one side—viz., A_2 and A_2

$\frac{60{,}000}{46}$ = 13,044 for vertical pressure and vertical lift respectively.

$$13{,}044 \times \frac{v_1 + v_1}{v_1 + v_1 + v_2 + v_2} \text{ or } \frac{13{,}044 \times 111}{157} = \text{say } 9230 \text{ lbs.}$$

which divided between the two points = 4615 lbs. *each*. The pressure on the other two points A_1 and A_1 will equal the balance, or 13,044 − 9230 = 3814, or 1907 lbs. on *each*.

Summing up, we have pressure—

On A_2 A_2 A_2 and A_2 = 4615 lbs. on *each*.
On A_1 A_1 A_1 and A_1 = 1907 ,, ,,

The *maximum vertical thrust or lift* on any particular guide (for a pressure of wind of 25 lbs. per square foot) would be 5000 lbs. In The Gas Institute paper it was stated to be 1250 lbs.

But it must be noted that this *vertical pressure* acts upon an *inclined* guide, causing a wedge action to come into play. If the guides are at an angle of 45°, the direct reaction on the bottom roller axles would be an increase in the proportion of 1 to the $\sqrt{2}$. This, therefore, increases the shearing strain from 5000 to 7071 lbs.

Then we have to allow for the *horizontal reaction* at the base, already alluded to. The *side* rollers A and A_1 may be relied upon for resisting the greater proportion of this force; and as they are the least strained by the vertical reaction, it is well that it is so. Its value, distributed over all the rollers, is 30,000 lbs. Without going into niceties over *this* force—which did not receive *any* consideration in The Gas Institute paper—we may safely conclude that 1-15th of it would have effect upon the roller axle under consideration; bringing up the total to fully 9000 lbs. Then, we must remember that this does not allow for the possibility of snow resting on one side of the crown in a storm, which would aid the tilting tendency, and increase the vertical pressure accordingly. It also assumes the structure to be *perfect* in construction and rigidity of parts—that is, every part doing its fair and proper share of the work—and to work without friction or obstruction of any kind. But it is only fair to provide for contingencies, which we may put down at 1000 lbs. at least on the most severely-strained roller, bringing the total up to 10,000 lbs.* for a 25-lb. wind pressure. The reviewer's 1250 lbs. therefore fades into insignificance; being *one-eighth of what it ought to be*. But for the correction of the wind pressure—allowing it to be 25 lbs. instead of 50 lbs. as given in the paper—it would be *sixteen times* under the mark.

It will be noticed that the effect of the forces upon the *bottom curb* of the holder has not been dealt with. This in itself is a most interesting study; but as it formed no part of The Gas Institute paper or the "Review of a Criticism," it is passed over. It may, however, be mentioned that it is of considerable importance when determining the strength of the holder. The same may be said of other much more serious and important questions connected with the strength—or rather weakness—of the Gadd and Mason patent gasholder, and of which no mention has been made by the inventor, although some reference to them might have reasonably been expected in a paper professing to deal with "The Principles involved in the Construction of the Northwich Gasholder."

* This 10,000 is the direct force acting upon the axle through the roller. The axle is a cantilever, and must be so treated; but it is unnecessary to enter into this in the present article.

THE CHEMISTRY OF ILLUMINATING GAS.

By Norton H. Humphrys, Assoc. M. Inst. C.E., F.C.S.

XLVII.

Condensation.

Under the head of "Condensation" may appropriately be included the treatment to which gas is subjected from the time it leaves the retort until it is delivered at the inlet to the washers or scrubbers. The advancement in respect to this department has been greatly hindered by several circumstances. First, we find that although the behaviour of the gas under various conditions during the act of cooling or of separating tarry matters has repeatedly been the subject of elaborate investigations, these have always commenced at the outlet of the hydraulic main; that is to say, after one-third or one-half of the total condensable matter has been separated, and the temperature reduced more than one-half. If so much care should be taken in finishing off, in the precipitation of the last half of the tar, and in effecting the last 100° of reduction in temperature, one cannot but wonder whether it would not be more advantageous to start at the beginning, and extend the same care with regard to gradual cooling, &c., right back to the very mouth of retort. It is probable that the gas suffers a greater degree of reduction in temperature during the time it is travelling up the ascension-pipes than it does while passing through the whole of the plant included under the term "condensing apparatus," as popularly used. And if a sudden reduction of temperature to the extent of 20° or thereabouts is prejudicial to the quality of the gas, what must be the result of the progress through the ascension-pipes and hydraulics, which may really be described as a sort of "slow-speed" condenser and a hot washer. Then there is always a tendency to mix up the work of purification with that of condensation. It is generally the custom to claim for any new invention that is to separate the tar, prevent naphthalene deposits, improve the quality of the gas, and generally give the advantages that are to be expected from a better system of condensation; also that it gives a certain quantity of ammoniacal liquor. Or possibly analyses showing the percentages of the various impurities removed from the gas are quoted. Most of us are acquainted with the street performer who ingeniously manages to play a number of musical instruments at one time; but it is questionable whether he produces as good music as would result from the distribution, amongst an appropriate number of competent performers, of the various instruments crowded upon him. In a similar manner it may be questioned whether an apparatus that cools the gas and secures the precipitation of the tar, can also at the same time effectually wash the gas with water. A certain amount of ammoniacal liquor must of necessity be precipitated with the tar; but there are several reasons why it would be better to reserve the watery fluid for use in a subsequent process, than to attempt an intimate contact with the gas at this stage.

A third cause which has hindered advancements in the matter of condensation, particularly of late years, is the general air of vagueness and uncertainty that has grown up around the question. A large number of investigators have pursued the subject with a directness of purpose that leaves nothing to be desired. The Rev. W. R. Bowditch, Mr. William Young, Mr. Henry Aitken, Mr. R. H. Patterson, Mr. G. Livesey, MM. Cadel, Chevalet, Brémond, and others, might be named as examples of those who have laid down useful guiding lines. Yet with all this matter available, I have seen some examples of modern ideas on the subject of condensation that are little better than a jumble of the phrases "light tar," "heavy tar," "light hydrocarbons," "heavy hydrocarbons," "hot condensation," "removing products at high temperatures," "importance of adjustment of temperatures," &c. The terms "hot" and "high temperature," for instance are used by some speakers as representing 300° or 400° Fahr.; while others evidently mean anything considerably above atmospheric temperature—say, 100° or thereabouts.

Another consideration is the fact that there is no point upon which gas engineers are more conservative than that of condensation. After a winter's experience with the vagaries of naphthalene, for example, they are only too thankful if they can hit upon a plan that will ensure immunity from this pest, and give fairly satisfactory results. Once so fortunate as to secure this *desideratum*, a great temptation must be offered to induce the engineer to try new condensation schemes. It must also be confessed that many so-called improvements have turned out to be rather erratic and unmanageable in practical operation, if indeed they should not be classed as failures. The number of appliances in connection with condensation that have secured anything like general favour is very small. On the other hand, the number that have been introduced, and perhaps tried at three or four different works—producing results to which public attention is directed—which have not only failed to find further favour, but have gradually sunk into oblivion, is large. Perhaps this is the reason why, in spite of all that has been written and said about the importance of systematic condensation, and the defects of the existing arrangements, the latter still continue in use as regards at least 90 per cent. of the gas that is made. In England, at any rate, the general rule is this: First the ascension-pipe; then the time-honoured, much-abused, but withal trustworthy hydraulic main; next the long and large foul main; and lastly a set of annular or pipe condensers. It is also remarkable that the practice in condensation appears to follow national

lines. England, for instance, may be called the home of the foul main; frictional condensation is generally used in France; while our American brethren like to have something in the way of hot condensation.

The object of condensation is to remove all matters amenable to mechanical treatment, that are likely to give trouble farther on, either in the purifying, the storing, or the distributing apparatus. The importance of thoroughly removing everything that is likely to appear as a tarry or an oily deposit during the application of solid or liquid reagents to the gas, cannot be too strongly insisted upon. Such deposits have the effect of clogging the purifying material, and interfering with that intimate contact which is so essential to economical and efficient purification. The presence of deposits in the holders, mains, services, or meters is also objectionable, not merely from the liability to cause stoppage of the supply, but because they absorb valuable light-giving constituents from the gas. So far there can be no disagreement. On the question of the proper temperature at which the gas should leave the condensers, however, there is some difference of opinion. While many prefer to reduce it to that of the atmosphere at this point, others talk about the evil effects of "over" condensation, and assert that the gas should not be reduced below a certain temperature—say 60° Fahr.—at the outlet. So long as the operations of washing, purifying, and storing are conducted in vessels freely exposed to outdoor temperatures, it seems absurd to talk about allowing the gas to leave the condenser at or about a fixed temperature. What is the use, for instance, of taking care not to reduce the gas below 60° in the condenser, but letting it go at this temperature into the scrubber, where it meets with a sudden douche of water at (say) 40°, and afterwards into a purifier and holder at 32° or less? Any advantage secured by careful adjustment at the outlet of the condenser will be lost unless the gas can be protected right through to the burner of the consumer, from further loss of temperature. Granting that such reduction to atmospheric temperature may lead to a further separation of hydrocarbons, and to some loss of illuminating power, it is of no use to put a high-quality gas into the holders, if such quality cannot be maintained right away to the premises of the consumer; and if immunity from further deposits is to be secured, the gas must obviously be reduced, in the condensing apparatus, to the lowest temperature it is likely to reach in the course of its existence.

Assuming this to be allowed, we now come to the question: What is the advantage gained by systematic condensation, as compared with the usual plan of providing apparatus of ample capacity, and then leaving matters to take care of themselves? By the term "systematic" condensation, I understand the adjustment of the extent of apparatus in use, according to the quantity of gas being made, or to climatic variations. Apparatus capable of dealing with the maximum make is provided, and divided into two or more sections, so that either one or any number up to the full capacity can be worked, as may be desired. While there is no necessity for maintaining the whole in operation at a time when half is more than sufficient, there will not be any prejudicial effects on the gas by doing so, if all is as it should be. If the inner surfaces of the condensing apparatus are coated with tar, it is possible that the quality of the gas may suffer by contact therewith. But if everything is properly designed at the inlet end of the apparatus, there will be no tar that is worth the name at or near the outlet end. There may be a little light and thin oily matter; but nothing of a nature likely to injure the gas.

The application of the plan of systematic condensation in such a way that, day and night, summer and winter, the gas should be delivered at the outlet at an even temperature, not varying, let us say, between 55° and 60° Fahr.—or, to put it another way, that the gas should leave the condenser just so soon as it had parted with its condensable matter, not before and not after—would call for a great deal of care and continual attention. On account of circumstances that need not be noticed here, the make of gas is varying from hour to hour; and not only this, but the atmospheric conditions vary also. Apart from the effect of sudden sunshine, storms, cold wind, snow, &c., all of which can, and undoubtedly should, be guarded against, the temperature of the atmosphere will vary through a range of 20° in as many hours. So that it would either be necessary to house the apparatus, and adopt special precautions for maintaining the temperature at the desired degree, or else to tell off an attendant for the special duty of watching the thermometers, and adjusting the condensing arrangements accordingly.

Since it appears then that any refined process of condensation would mean trouble and expense, with but little tangible advantage, the best plan is to go no farther in this direction than to place the condensing apparatus under cover in a sheltered locality, and possibly to divide it into two or three sections, which can be used according to the make of gas. The condensing apparatus, as a whole, will be so designed as to be capable of dealing with the maximum requirement; and it is well to provide each section with a separate overflow-pipe, so that the quantity of fluid deposited therein can be easily estimated. A cased thermometer of the usual construction will, of course, be used in each instance; and by carefully watching the quantity of fluid deposited, and the reduction of temperature, it is easy to form an intelligent idea of the action going on. It is not a difficult matter to arrange the overflow so as to admit of the introduction of a measuring vessel, whereby accurate estimates can be made of the quantity of liquor deposited, and samples of the liquid obtained for examination.

The numerous forms of apparatus used for condensation may be resolved into two classes—chamber condensers and friction condensers; and many of those in common use combine the characteristics of both. In the chamber condenser, the gas moves so slowly that opportunity is afforded for even the finest suspended matters to settle out of it; and in the friction condenser the same result is obtained by causing the gas to impinge upon surfaces suitably arranged. A pipe condenser may partake more especially of one or other of these principles, according to its proportions. If sufficiently large in sectional area to allow a rate of travel for the gas of not more than a few inches per second, it is a chamber condenser. But if the gas moves through it at a comparatively rapid rate, then it depends more for its efficiency on the contact of the gas to the sides of the pipe, the impact afforded by bends and curves, &c.; and it is practically a friction condenser.

The annular condenser, which is by far the most popular form of apparatus, probably depends for its efficiency not so much on the large extent of surface to which the gas is exposed as on the effect of impact afforded to the gas at the inlet of each column. The gas entering at the inlet-pipe strikes directly on the surface of the inside cylinder, which is opposed to it, and then diffuses itself into the annular space. When the annular condenser is fixed close on the outlet from the hydraulic main, this action is apt to manifest itself in a very disagreeable way, by frequent stoppages at the base of the first column. But, as a general rule, the "annular" is used as the finishing apparatus. The difficulty experienced with any arrangement of the friction kind is that, after a time, the surfaces become coated with a very viscid gummy sort of pitch, which greatly interferes with the efficiency of the condenser, besides tending to impoverish the gas. This difficulty is the more marked the nearer the apparatus is fixed to the hydraulic; so that possibly the general modern practice of commencing with a foul main having dimensions sufficiently large to enable it to act chiefly as a chamber condenser, and finishing with an annular condenser, is really sound in principle.

TECHNICAL RECORD.

THE UNBURNED GASES FROM GAS STOVES AND BURNERS.

In the JOURNAL for Sept. 16 last (p. 602), we published an abstract of a paper on "The Unburned Gases contained in the Flue Gases from Gas-Stoves and Different Burners," read by Mr. W. THOMSON, F.C.S., of the Royal Institution Laboratory, Manchester, before the Chemical Science Section of the British Association. We have since received from the author the full text of his paper, which, in view of the interest attaching to the subject dealt with, we now give.

I have been working for some time with a view of determining whether the gases escaping as flue gases from gas-stoves and different burners are really free from gas capable of combustion, such as carbon monoxide, or unburned hydrocarbons or hydrogen. I spent some time in trying to separate and determine the quantity (if any) of carbon monoxide present; but this problem was beset with so many difficulties that for the moment I abandoned it, and contented myself with determining the quantity of unburned carbon and hydrogen, in whatever forms these might exist. For this purpose I arranged an apparatus consisting of two carefully-weighed U-tubes filled with strong sulphuric acid, and two weighed U-tubes filled with soda lime, through which the flue gases were first passed. These absorbed the water and carbon dioxide contained in the gases, leaving the hydrocarbons (not absorbed by vitriol), hydrogen, and carbon monoxide, to pass through a red-hot glass tube filled closely to the extent of 15 inches with oxide of copper prepared *in situ* from copper wire gauze. The gases were then passed through strong sulphuric acid and soda lime contained in previously weighed U-tubes; and the results were calculated on the gas measured at 60° Fahr. and 30 inches barometric pressure, from the measure of gas drawn into the aspirator (treated as water-saturated gas). The carbon dioxide and water vapour absorbed in the tubes were then added, to make up the measure of flue gas originally employed, which was taken for the determinations. The coal gas employed was previously passed through large cylinders filled with calcium chloride, in order to dry it before combustion; and at the same time as the experiment was going on, and side by side with it, was estimated the carbon dioxide and water vapour present in the air itself, by passing it, by means of another aspirator, through strong sulphuric acid and soda lime in U-tubes previously weighed.

The carbon dioxide in the air itself ranged from 0·41 to 0·66 grain per cubic foot of air; and the water from 3·51 to 7·23 grains in the same volume. The amounts of carbon dioxide and water collected from the flue gases, after deducting the quantities actually present in the air, were taken as those due to the combustion of the coal gas. The standard I employed

was the one used by Professor Roberts-Austin in his analysis of the flue gases from the burning of coal; and the apparatus was generally similar to that used by him. The carbon and hydrogen left unburned were measured in terms of 1000 parts of carbon actually derived from the combustion of the gas in the stove or burner. The total quantities of carbon dioxide and of water in the flue gases amounted to from 6·6 to 10·8 grains per cubic foot for the former, and from 5·6 to 10·5 grains of the latter, in the same volume. The amount of flue gas passed in each experiment was about 1 cubic foot; and although the variations were considerable, the general results were conclusive in showing that the combustion of gas when burned in gas-stoves for heating purposes is much more incomplete than one might be led to suppose.

The only burner in which the weight of the tubes remained constant after passing the burned gas, and in which the combustion was presumably complete, was in a paraffin oil-lamp in which the flame was not turned to its highest point. In another experiment, with the flame turned full on, 12·04 and 3·09 parts respectively of carbon and hydrogen escaped combustion per 1000 parts of carbon completely burned. The next nearest approach to complete combustion was in an Argand burner, in which all the carbon was completely burned. But an amount representing 0·2575 part of hydrogen escaped combustion per 1000 parts of carbon completely burned; while in a second experiment, 0·113 part of carbon and 2·5414 of hydrogen escaping combustion were registered per 1000 parts of carbon completely burned. Then came one of Bray's ordinary flat-flame burners, consuming 4 cubic feet of gas per hour, which gave 11·12 parts of carbon and 0·95 part of hydrogen unburned per 1000 parts of carbon completely burned. Following in order these results came the Welsbach light, in which the gas heats to whiteness a "mantle" composed of a filmy thickness of the oxides of zirconium and titanium; the mantle being surrounded by a glass tube similar to that used in some paraffin lamps. In this case the unburned carbon exceeded in amount the unburned hydrogen; there being 15·486 parts of the former and 3·794 parts of the latter per 1000 parts of completely burned carbon.

Three experiments were carried out with a Marsh-Greenall heating-stove, in which three of Bray's luminous burners were employed. The first was made with a consumption of 5·62 cubic feet of gas per hour, when 12·6 and 3 parts of carbon and hydrogen respectively were registered per 1000 parts of carbon completely burned. The second experiment gave, with a consumption of 5·74 cubic feet of gas per hour, 37·6 and 11·8 parts respectively of carbon and hydrogen unburned. The third, with an increased consumption of gas (7·1 cubic feet per hour) gave 97·4 and 12·1 parts of carbon and hydrogen respectively unburned.

Two experiments were made with one of Mr. T. Fletcher's heating-stoves, in which eight Bunsen burners played upon some fancy metal-work (iron coated with magnetic oxide). One experiment, in which the amount of gas passing was not measured, gave 43·3 parts of carbon and 24·6 parts of hydrogen unburned per 1000 parts of carbon completely burned. In the second experiment, where 6·81 cubic feet of gas were burned per hour, 66·3 and 20 parts respectively of carbon and hydrogen unburned were registered.

An experiment was made with one of Mr. T. Fletcher's stoves in which 20 Bunsen burners played upon asbestos projecting from a fire-clay back. With a consumption of 8·14 cubic feet of gas, 138·9 and 11·7 parts respectively of carbon and hydrogen per 1000 parts of completely burned carbon were found.

In a stove in which the hot gases rose to the top of a cylinder filled with pipes (through which cold air passed to be heated), and from the botton of which the burned gases escaped after having cooled to a considerable extent, upwards of 200 parts of carbon escaped combustion per 1000 parts of carbon completely burned.

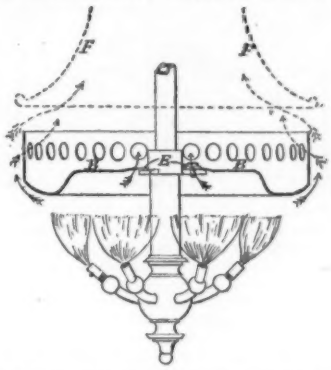
Proposed Taxation of Subsoil Occupied by Gas and Water Pipes in Chicago.—The Chicago City Council have before them a proposition for imposing a tax for the occupancy of the thoroughfares by gas and water pipes. If this proposal obtains their sanction, no ordinance will in future be granted by them authorizing the laying of these pipes, or putting down any electric conduits or wires, through any public highway, except on payment into the City Treasury, by the persons seeking this privilege, of at least 5 per cent. per annum of the gross revenues accruing from the operation of the plant during the term for which the ordinance is granted.

Toronto Water Supply.—A water famine is imminent in Toronto, according to the *Globe* of that city. The supply has been deficient for some time; and in 1889 contracts were let for increasing the capacity of the intake pipe, and replacing a wooden section of the pipe with steel. The Rose Hill reservoir, with a capacity of 40 million gallons, which receives the surplus water after it has been pumped through the distributing system, has finally been completely exhausted; and the supply is so limited that, for a time at least, the service of hydraulic motors and for street sprinkling has been refused. With the completion of the improvements to the conduit, a daily supply of 42 million gallons can be delivered to the pump well; but the pumps have a combined nominal capacity of but 22 million imperial gallons, and a working capacity at present considerably less.

REGISTER OF PATENTS.

Gas Lighting Appliances.—Rowson, F. G. and J., of Manchester. No. 19,048; Nov. 27, 1889. [6d.]

This invention refers to an improved form of "sun-light;" and, as shown in the engraving, the lamp consists of (say) six burners provided with a reflector B, made of sheet metal stamped into form and coated with glass enamel on the surface next to the lights. The central part of the reflector is flat, and is bounded by a curved edge, which projects to a comparatively small extent from the flat part in a downward direction or towards the burners. In the centre of the reflector is an



opening E, for the upward escape of a portion of the products of combustion. The opening is comparatively less than the escape opening in the ordinary basin-shaped reflector; the intention being that only part of the upward current of heated gases shall pass through it, the other and probably greater portion flowing round the edge. This, it is said, increases the steadiness of the flames. The heated gases are conveyed away by an escape-pipe F.

Alluding to this arrangement of light, the patentee says: The reflector, being only removed a short distance from the cluster of flames, becomes highly heated; and, as a consequence, does not retain smoke deposit. Other advantages arising from the close proximity of the reflector to the flames are that the light is better reflected, and that the heat being also reflected downward toward the burners, the issuing gas and the air which come into contact with the flames become heated to a higher degree, as compared with the ordinary combination, whereby the effective duty of the burners is increased.

Water-Meters.—Lake, H. H.; communicated from the Rogers Liquid Meter Company, of Portland, Maine, U.S.A. No. 10,597; July 8, 1890. [8d.]

This invention consists in the combination in a water-meter of (1) an oscillating measuring cylinder, mounted on trunnions in an outer enclosing and water-containing casing; (2) an inlet-pipe opening into the outer casing, and a discharge-pipe opening from one of the trunnions; (3) an inlet-valve and casing, and an exhaust-valve and casing on each side of the trunnion, and between it and the end of the cylinder pipes connecting the discharge trunnion with each exhaust casing, each of the exhaust casings with an inlet casing, and each inlet-valve casing with the interior of the cylinder; and (4) two valve-operating levers, supported in fixed bearings at their outer ends, and each extending inwards beneath an inlet and an exhaust valve in such positions as to act upon the lower ends of the stems of the valves, projecting through their casings, and pivoted at points central between the outlet and exhaust casings to bars connecting the casings.

Water-Meters.—Tarda, P., of Barcelona, Spain. No. 11,224; July 18, 1890. [8d.]

This invention relates to water-meters, the characteristic features of which are—(1) Two distributors, each formed by a cylinder with perforated walls; the perforations being arranged in three circular series or tiers arranged on its circumference. There are within each cylinder two pistons, or a double piston arranged on one and the same rod, having the necessary space between them, so that two of the series of openings are always in communication with the space enclosed between the two pistons. Thus the water arriving by the holes in the central tier flows through the holes in either the upper or the lower tier according to the position of the pistons, and consequently is directed towards the upper or lower part of a cylinder provided for measuring it. (2) The combination of two distributing cylinders, with two other cylinders for measuring the water; so that the piston rod of each of the measuring cylinders, being moved by the pressure of the water, transmits proper motions to the piston or pistons of the distributor in connection therewith, and the water which passes by each distributor flows for measurement not towards the cylinder, which receives the impetus, but towards the other cylinder. (3) The manner of connection between the rod of the double piston of the distributor and that of the piston of the measuring cylinder in connection therewith. The rod of the piston of the distributor is hollow; and in its interior rests the head of the piston rod of the measuring cylinder, which head may move freely therefore in the interior of the rod of the distributor in longitudinal direction within limits previously determined—that is, until the moment when the direction of the water current is to be changed. At this moment the rod of the measuring piston, following its course, carries along the piston of the distributor; and the latter then uncovers the holes concealed while concealing, on the other hand, those which were uncovered. (4) The construction of the pistons of the measuring and distributing cylinders by providing them with an india-rubber plate arranged on the leathers, so that the latter rest continually on the sides of the cylinder and thus obtain a perfect joint although the water arrives at the ordinary pressure.

Testing Gas-Mains.—Moat, G., of Bingham, Notts. No. 13,431; Aug. 26, 1890. [6d.]

This invention relates to improvements in syphons or test-boxes for gas-mains; and its object is to facilitate the testing of three-way or four-way mains.

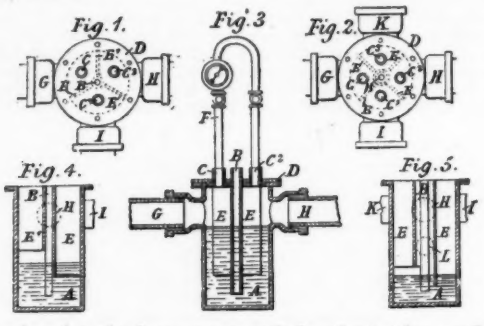


Fig. 1 is a plan of a three-way gas-main junction test-box; and fig. 2 is a plan of a four-way box. Fig. 3 is a vertical section of fig. 2, with a leak indicator attached. Figs. 4 and 5 are vertical sections, showing modified constructions of a three-way and four-way syphon or test-box respectively.

The syphon or test-box A, which is sufficiently deep to permit hydraulic sealing, is provided in its interior with three or four gas-tight radial partitions E, which do not reach to the bottom of the box, but extend sufficiently far down to project well into the water when the box is sealed. Otherwise they permit a free and uninterrupted flow of gas. The box is provided with the usual cover D, which is preferably formed with a central opening or tube for the water-pipe B, through which the water is introduced and withdrawn when necessary. The water-pipe extends to near the bottom of the box, and passes preferably through an opening formed at the junction of the radial partitions E. The cover is further provided with three or four tubes C, C^1, C^2, C^3, according to the number of radial partitions the box is provided with; and to these tubes the branches of the leak indicator F are connected during the operation of testing. The pipe B, and the tubes C, C^1, C^2, C^3, have gas-tight plugs or caps, which are only removed during the testing, as occasion demands.

When it is desired to test any main, the plug or cap of the water-pipe B is removed, and the box filled with water nearly up to the level of the mains, as in fig. 3. The partitions E projecting well into the water, the box is thus divided into three or four separate chambers, in each of which terminates one branch of the mains. It is, of course, to be understood that the neighbouring box or boxes of the main or mains to be tested must also be thus sealed. Supposing that the main G is the live main, the plug of the tube C is removed, and one of the branches of the leak indicator connected in the usual manner; and when it is desired to test the main I, the other branch of the leak indicator is connected to the tube C. For testing the main H, the second branch of the leak indicator is connected to the tube C^2, as in fig. 3; and, for the main K, to the tube C^3. The tap or cock of the leak indicator is then opened; and the index finger of the indicator will either pronounce the main sound by remaining stationary, or indicate a leak in the usual manner.

In order to permit the testing of the branch-pipes, and to permit the gas still to flow uninterruptedly through the main trunk pipes, the partition E^1, as in fig. 4, is constructed somewhat shorter than the partitions E, in the three-way syphon or test-box; so that, by filling the latter with water up to the level shown in fig. 4, the gas will still pass underneath the partition E^1 from the main G to H, or *vice versâ*, while the chamber communicating with the branch I is perfectly sealed by the partitions E projecting sufficiently far into the water.

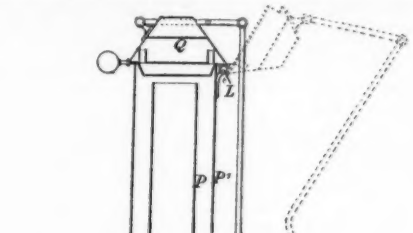
To effect the same purpose in a four-way syphon, the central opening at the junction of the radial partitions, through which the water-pipe B passes, is constructed somewhat larger, and an opening L is formed on each side of it, below the level of the main-pipes. It communicates with the chambers of the main trunk pipes, so that, by filling the box with water up to the level of the openings, the chambers of the branch I, K, will be sealed; while the gas will still pass from the main-pipe G, to H, or *vice versâ*, through the openings and round the pipe B.

When it is desired to test the mains, the test-box in each case is filled with water up to the level of the mains, as usual, when all the compartments or chambers will be sealed. After the testing is over, the pump is attached to the water-pipe B, the water withdrawn from the box A; and the mains are again ready for use after the caps or plugs are replaced on the pipe B and tubes C, C^1, C^2, C^3.

Regenerative Gas-Lamps.—Suhr, H., of Hamburg. No. 13,798 Sept. 2, 1890. [6d.]

This invention relates to regenerative gas-lamps, and consists principally in the method of admitting and preheating the fresh air intended for the lower part of the flame. It further consists in providing the lamp with a protecting lid, for preventing the admission of rain when the lamp is for outdoor use; and in connecting this lid with the cock of a supplementary burner, which serves for lighting the lamp.

The illustration shows a street-lamp in longitudinal section. To the metal frame A A^1 are attached (below) the inner and outer glass globes B, B^1. Within the inner globe is the burner C, which receives the gas from above by a pipe in connection with the main-cock E. The fresh air enters from above into the hollow space between the metal-plates A A^1, and travels in the direction of the arrows through concentric metal rings, to the upper surface of the flame, and partly through openings in the lower metal frame A; and after passing a horizontal deflecting plate, it enters the inner globe B to the outer surface of the flame. The openings in the lower metal frame A^1 permit part of the air on its way to the flame to travel through the outer



glass globe, partly to cool it and protect it from cracking, partly for the purpose of preheating the globe B. The chimney P is encircled by a larger tube P^1 concentric therewith, which is closed above by a lid Q moving on a hinge. This lid has a conical upper protector, and (at the widest part) an intermediate plate, which prevents the rain from entering the lamp. The escaping gases leave by the tubes that are located underneath the slant of the protector; and are thus shielded against the entry of rain. In the lid are arranged wire sieves through which the escaping gases pass.

In order to light the lamp and work it, a supplementary burner X is arranged below in the chimney, in connection with the gas-supply pipe. Upon opening the lid Q the cock Z is opened at the same time, by means of the levers shown. When the lamp is to be used, the lid Q is opened, so as to admit gas to the supplementary burner to be lighted from above through the chimney. After the supplementary burner has been lit, the main-cock is opened to admit gas to the burner C; and on this being lighted by the supplementary flame, the lid is shut down and the supplementary flame is thereby extinguished.

Tanks or Reservoirs.—Pridham, T., of Petersham, New South Wales. No. 14,265; Sept. 10, 1890. [6d.]

This invention refers to the construction of steel or iron tanks or reservoirs, so as to diminish the first cost, expense in carriage, and maintenance charges, by combining a metal shell with, over, or upon an artificial bottom—such as concrete masonry, puddled clay, or the like—and (as, owing to the expansive qualities of the various metals, it is not possible to make a rigid water-tight joint between the shell and the bottom) providing a connection between them, which will allow the shell to expand and contract without leaking through the connection.

Gas and Vapour Engines.—Hamilton, J. H., and Rollason, A., of Sandiacre. No. 16,434; Oct. 18, 1889. [1s. 1d.]

This invention in gas or vapour engines has reference to certain novel methods of arranging and operating the valves, of governing, of effecting the ignition in, and of starting such engines, as well as to modifications of constructive details. In the specification, the improvements are described as applied to engines of the three-cycle class, though they are equally applicable to engines of the two-cycle type, and some of them are applicable to all compressive gas or vapour engines. The particulars would not, however, be understood by a mere summary of the somewhat lengthy specification—extending as it does to 14 closely-printed pages, accompanied by four sheets of detail drawings—and we have no space for reproduction in full.

APPLICATIONS FOR LETTERS PATENT.

17,159.—Springler, T. G., "Improvements in the manufacture of gas." Oct. 27.

17,188.—Rogers, J. E., "Improvements in gas supply governors." Oct. 28.

17,201.—Vestraut, L. van, "Improvements in setting inclined carbonizing or gas retorts." Oct. 28.

17,277.—Wotherspoon, R., "An improved method of and apparatus for the electrical treatment of sewage, air, gases, and other fluids." A communication from H. Rowley. Oct. 29.

17,299.—Mottershead, D., "Improvements in or connected with gas-engines." Oct. 29.

17,371.—Higginson, J., jun., "Improvements in gas-engines." Oct. 30.

17,428.—Thompson, W. P., "Improvements in or relating to gas-stoves." A communication from L. Lobet. Oct. 31.

17,453.—Slater, J. W., and the Native Guano Company, Limited, "Improvements in the preparation of agents for use in the purification of sewage and other polluted water by precipitation, and improvements in the treatment of sewage and other polluted water, in order to effect the purification thereof." Oct. 31.

17,456.—Roberts, G., and Hally, G., "Improvements in gas and hydrocarbon vapour burners." Oct. 31.

CORRESPONDENCE.

[We are not responsible for the opinions xpressed by correspondents.]

Gaseous Fuel.

SIR,—In the JOURNAL for Oct. 21, p. 858, some very misleading statements concerning the gas made in my apparatus, are attributed to Mr. G. E. Davis, in his recent lecture at Manchester, on "Manufacturing Smoke;" and I beg you will be so good as to allow me to make a few remarks in reply.

Mr. Davis says that 6000 cubic feet of my gas are only equal in heating power to 1000 cubic feet of ordinary coal gas, and that he understands that the gas made in my apparatus costs 4d. per 1000 cubic feet. Permit me to say that, according to Professor W. Foster's analysis, the calorific power of my gas made from small low-grade anthracite, costing only 3s. 6d. per ton, is as 3·8 : 1 compared with ordinary lighting gas. Roundly we may say that four volumes of mine are required for one volume of the other; and it has been proved over and over again by heating tests, and by engine trials, on a large and small scale, that this ratio can be maintained in average work. It is true that some years ago, when my gas was first used for driving "Otto" engines, it was necessary to allow five volumes of my gas for one volume of the other; but for some time past this has ceased to be the case—not because the gas has been changed, but because the engine has been better adapted for the use of such a gas as mine. I speak from experience, as over 4000 indicated horse power are now working with this gas under very varied conditions.

As regards the cost of the gas, with fuel at 12s. a ton, and when made on a moderate scale, it is usually about 2½d. per 1000 cubic feet, including a sufficient allowance for wages of attendant, repairs, &c. If, therefore, this price is multiplied by 4, it will be seen that the *equivalent of 1000 cubic feet of ordinary town gas, costs only* 10d. When the gas is made on a large scale, the cost is still less, as the production of gas is greater in proportion to fixed charges for wages, repairs, &c. For instance, with a large plant at the well-known cocoa works of Messrs. Van Houten and Son in Holland, the certified cost of the equivalent of 1000 cubic feet of the town gas, with which comparative tests were made, was only 6½d., while the anthracite cost 16s. a ton.

More recently, the cost has been still further reduced, as I have succeeded in working with ordinary gas-coke of small size; and a set of my apparatus is now working daily with this cheap fuel at the well-known works of Sir W. G. Armstrong and Co., at Elswick.

Town gas is too costly to use for the large sizes of engines now made; but the sale of small, clean gas-coke, to be converted into gas in my apparatus, opens up a new field for gas companies; and I think the matter is worthy of their attention.

Westminster, Nov. 4, 1890. J. EMERSON DOWSON.

Mr. Cripps and the Gadd and Mason System of Gasholder Construction.

SIR,—I do not desire to fill your pages with superfluous matter which may not go straight to important points of this controversy. I will therefore pass over the wearisome reprints and repetitions in the first part of my critic's "rejoinder," and only refer, in passing, to the strange, far-fetched misrepresentations of the meanings of my words which he has found necessary for the purpose of making a case. I will say that these imported meanings which are put on my remarks—more especially, for instance, those on angular force—are distorted and grotesque in the extreme, and such as I have not previously ever dreamed of. It was a revelation to me to find such interpretations could, by any perversion of ingenuity, be invented. I completely repudiate them, nevertheless. They form repetitions of the "man-of-straw" method with a vengeance.

The elementary articles of mechanical faith that the critic finds it necessary to print, I most fervently do believe. I think I swallowed the whole six, with some others, somewhere about the age of 16, which is some little time ago now.

The misrepresentations regarding figs. 5, 6, and 7 are fairly obvious, and to my mind gross enough; but in fig. 8, he goes the length of falsifying my illustration, by adding a fixed pulley and weight, which does not exist in the experiment, and is nowhere in my description even hinted at. Indeed, I fully cautioned him, in my last article, against fixing the application of the force at a constant of 90°. Yet, with his usual peculiar habit of mind, that is the very thing he at once goes and does. The insertion of a note at that point suggests strongly that he, at least, is *partly* conscious of the terrible wrong he is doing. His brutalizing insinuations as to my truthfulness are beneath notice here; but I cannot permit him to continue to indulge therein further. I will present him with the fact that there is *another* error of figures in my paper, unfortunately unobserved in "proof," which he may find will prove I do not understand the principles of common multiplication and division. I hope to be permitted to put these figures right in the printed "Transactions."

When we come to fig. 10, we get to something which constitutes the critic's first attempt to substantiate his criticism, or one part of it. In so doing, however, he really and fully *proves my case*. To obtain a second vertical force of x, he coolly splits up again the diagonal resistance z into its original components. But what an outrage, when he knows, if he has read the paper he criticized, that I gave the vertical *and* diagonal forces, acting *together* on the holder. Hence, in fig. 10, we have by my method, on *each* side, a total resistance of $\frac{x}{2}$ vertical + $\frac{\sqrt{2x^2}}{2}$ diagonal. Why could not the critic have the candour to tell your readers that this is *exactly equivalent* to the split forces he shows in fig. 10? He knows he cannot develop this second x vertical except by annihilation of the diagonal force, as such; and thus making x vertical + $\frac{x}{2}$ horizontal resistance only on each side—which is of the same mechanical value, precisely, as the forces I have given. The process he adopts savours much of trick, to try and prove the existence of one thing, by the suppression of another—like a man, who, having a balance of cash in two separate banks, draws a cheque upon one, and pays it into the other, fondly imagining he is the amount of the cheque the richer.

Further, if we construct new and final resulting resistances from these lines, whether adopting Mr. Cripps's forces or those I hold to be the more correct, because more actual developments, we obtain precisely the same results—viz., two single forces. These are neither vertical nor diagonal, be it observed; but they balance the original horizontal wind force, each of the value of $\frac{\sqrt{5x^2}}{2}$. In the triangle a, b, c, why does not Mr. Cripps locate the neutral centre? And, as the final results of his triangle are identical with the forces of my paper, why did he take the position he did? Evidently he is getting light.

His remarks on figs. 11*a* and 11*b* I cannot see the object of. They certainly do not apply to *my* views in any way I can at present fathom. In quoting some of the expressions I have employed, which he evidently does not grasp the meaning of, he says the "less said of them the better." I am strongly of opinion he might with advantage have come to that conclusion much earlier.

Finally, I have before me, a clear and simple *physical* demonstration of the balanced forces, which I have prepared and shown to engineers, who are quite as qualified to judge as Mr. Cripps; and he or any one else is perfectly welcome to see the same, and say if the experiment is "properly conducted." The square is balanced against x horizontal in three ways: (1) With x vertical on one side, and $\sqrt{2x^2}$ diagonal on the other, as shown in the critic's unequally resisted fig. 10; (2) with $\frac{x}{2}$ vertical + $\frac{\sqrt{2x^2}}{2}$ diagonal on *each* side, giving equal resistances, and more nearly representing the actual; and (3) with $\frac{\sqrt{5x^2}}{2}$ single line resistances on each side. Not one of these triangles finds its neutral centre in the middle of the base line. For the rest, as Mr. Cripps has brought, at last, his total forces at the sides exactly equivalent to my own, I fail to see what good can be done by further controversy, although I have no desire to shrink from it in any way.

The best proof of the value of my invention lies in the fact that in England two are now working well; more are in construction; *many* are in negotiation; while in foreign countries (including the United States and Canada with the Continents of Europe and Australia), inquiries are simply pouring in. It will succeed, Mr. Cripps's kind attempt to hinder it a trifle notwithstanding.

Manchester, Nov. 6, 1890. W. GADD.

Temperature of Gas-Flames.

SIR,—In answer to a correspondent in this week's JOURNAL, who asks for the best authority on the temperature of gas-flames, I would refer him to a letter in the JOURNAL for Jan. 1, 1889, by Mr. Thomas Fletcher, F.C.S., and to the JOURNAL for May 21, 1889, which contains (p. 949) a table of the constituents and calorific value of coal, water, and producer gas.

Nottingham, Nov. 6, 1890. ERNEST JOHNSON.

The Gas Workers' Union and its Executive.

SIR,—I find your correspondent is still "on the trail." He seems to be off the scent lately; and now tries to get information through the columns of the JOURNAL. I do not know what he takes me to be. A fool, I suppose. Well, if he does, I cannot help that; but I assure him if he expects any more information than I gave him in my last, he is doomed to disappointment.

Your correspondent, judging from the length of his letters, has more ink than brains, and more paper than conscience. He cares not what becomes of the working men, so long as the class to which he evidently belongs to are all right. He says I am getting on in the world. Good job. I need not thank "In the Know" for that. I know where he would like to see me—in one of her "Majesty's Hotels." Well, I can assure him that, although I never was inside one of those buildings in all my lifetime, I would not fear going there to-morrow in a good cause—especially the noble cause of labour; and if ever it should come to pass, neither police, dragoons, nay, not even the gallows, would deter me from doing my duty. The amount of sarcasm displayed in his letter tells me clearly what he is bent on; but he may rest assured any reference he may make to my nationality will never offend me. That I am an Irishman, I always admitted—always have been proud of; and if he searches the best posts in the British service, I think he will find there men of the same nationality.

As for asking you, Mr. Editor, to provide a room for me and "In the Know" to meet this striker who told him "that for every day he worked the Executive Committee docked him half his wages," I simply said that if he produced a man who was served thus, I would give that man my week's wages. How much is that? inquires "In the Know." How anxious he is to be possessed of that knowledge—knowledge he can soon obtain by purchasing a copy of our rules.

By-the-bye, Mr. Editor, I have received three threatening letters, all dated from Southwark, stating that vitriol is waiting for me and others when the dark nights come on. These letters are written in a feebly disguised hand. A working man never wrote them. Does "In the Know" know anything about these letters? The reason he gives for not making his name public is that he shelters himself behind the "boycott and intimidation." As if I could in any way injure him with those weapons; and if I attempted to do so, he had his legal remedy.

Now, Sir, in conclusion I may state that I shall take no further notice of "In the Know's" correspondence until he comes out in his true colours, and has the courage to sign his name to the readers of the JOURNAL.

144, *Barking Road, E., Nov. 6, 1890.* W. H. WARD, Assistant-Secretary, Gas Workers' Union.

MISCELLANEOUS NEWS.

THE WATER-GAS EXPERIMENT AT HARROGATE.

In our editorial columns last week, reference was made to the recent collapse of the experiment in water-gas lighting which had been going on for about three months at Harrogate. Our readers have been furnished from time to time with particulars of this experiment, which necessarily excited considerable attention; but it may be interesting now to place before them the whole of the facts in a connected form, so that a right judgment may be formed as to the merits of the illuminant in question as a means of street lighting, as well as to its capability of competing generally with coal gas. This we are in a position to do by the aid of information supplied by a local correspondent, who has had exceptionally favourable opportunities of watching the progress of the experiment through all its stages.

In March last the Harrogate Corporation sought an interview with the Gas Company for the purpose of obtaining their consent to a trial of water gas in some of the public lamps, which, although they were the property of the Corporation, the Company had an existing contract for supplying with gas. At the interview, the deputation were informed that the Company had no power to sanction the disturbance of public thoroughfares for any purpose except the laying of pipes, &c., for conveying the gas they manufacture; and that it would be absolutely illegal for the Corporation to open the streets for the purpose they proposed, or to authorize any company or person to do so. The deputation challenged these assertions; but said the intention was either to supply the gas in bags, to lay pipes in the channels, or otherwise to get it in some way from the plant which had been erected at Grove House, the residence of the Mayor (Mr. Samson Fox), who was deeply interested in the British Water-Gas Syndicate, and desired to show what good could be done by the gas. The result of the interview was that the Gas Company agreed to remain passive in the matter so long as their rights and privileges were not prejudiced; at the same time stipulating that the experiment was not to extend beyond three months, and that all pipes and other apparatus were to be removed immediately after the expiration of the time fixed.

To the great surprise of the Directors of the Company, complete plant for the manufacture of water gas was commenced and erected in the Montpellier Grounds, in the immediate vicinity of some of the most valuable mineral springs, the most important portion of the town, within a few feet of business premises, and in the neighbourhood, where visitors drinking these waters are in the habit of promenading. The Montpellier Grounds are the property of the Mayor and Corporation, who gave their consent to this strange freak of indiscretion, which involved the possible destruction of their main source of income and interest—viz., the invaluable mineral waters of the town. The Directors might have interfered at this juncture, had not the Mayor and Corporation sanctioned the scheme. The public would, however, doubtless have misconstrued their interference, and attributed to them interested motives. It was stated that the Directors, on the other hand, were quite as anxious to show that coal gas could afford to await the result without anxiety; and they knew that the Council would have to take the responsibility of their own action.

The plant was erected, the streets opened to lay the pipes, and supplemental lamps-posts put up in the middle of the Harrogate season, notwithstanding that the Council had been censuring the Gas and Water Companies for laying their pipes some months previously, before the season commenced. One large water-gas lamp, containing 24 burners or "combs," was set up at the junction of Parliament Street and James Street, and 12 ordinary lamps, with two combs in each lamp, in Parliament Street. The burners supplying gas to the combs were Bray's ordinary No. 3. The pressure was stated to be the same as that of the Harrogate Gas Company, and at this pressure it was ascertained that the burners would each consume 10 cubic feet of gas per hour. Two of the lamps were afterwards fitted with four combs each; but the light had so little diffusive power that the small Sugg lamp, consuming 25 cubic feet of gas per hour, gave double the light procured by the four combs consuming 40 cubic feet. The ordinary lamps of the Corporation burn 5 cubic feet of gas per hour; but they have others of 10 feet and 30 feet. Those in Parliament Street are mainly 5 feet, though one or two will perhaps be 10 feet burners. The Gas Company erected a large Sugg burner, consuming about 40 cubic feet of gas, opposite their office, also a Bray lamp with a 3-light batswing burner, consuming about 30 cubic feet of gas, near the Post Office, as soon as the water gas put in an appearance. They also placed a smaller Sugg Argand in the centre of Parliament Street a short time before the termination of the experiment, which was expected to last until the 6th of November; but, as our readers are aware, it suddenly collapsed on the 23rd of October.

When the lighting of the water-gas lamps commenced on the 6th of August, there was an influx of visitors to the town, consequent on the meeting of the Yorkshire Agricultural Society; and a large number of strangers seemed to be very much interested in the water gas, and gathered in groups about it—eulogizing the "new beautiful light," and condemning the ordinary gas of the town. A few days, however, revealed the fact that these strangers were in many cases shareholders or persons interested in the welfare of the water-gas scheme; and for a while their little game went on merrily. But soon the consensus of disinterested opinion was that the coal gas was much superior in illuminating power to the water gas, although handicapped by four times the quantity of gas being used. Many gas managers from all parts of the Kingdom went to see the light; and whenever an opinion was expressed, it was to the effect that coal gas had nothing whatever to fear from the rival illuminant. The combs alone would condemn it; being so fragile and so difficult to adjust—requiring a skilled mechanic to start and regulate them, besides taking at least twice the time to light a given number of lamps, which could only be accomplished by the use of the old-fashioned ladder.

As regards the manufacture of the gas, the nuisance arising therefrom was so bad that several persons were made seriously ill by the noxious fumes that were produced. Others had their houses filled with offensive odours; doors and windows had to be closed. It was very difficult indeed to remove the stench from the houses. Many times it was detected hundreds of yards away, and persons had to leave the town for a time in consequence of the injury they received; and an injunction was applied for by one tradesman to restrain the manufacture of the gas, owing to loss of custom and damage to articles of consumption at his creamery.

On the 27th of August a pipe was taken into the Spa concert-room, in order to supply water gas to one of the Gas Company's consumers, contrary to the arrangement with the Council. The Directors of the Company remonstrated, and the Corporation took Counsel's opinion on their powers to supply water gas or other illuminant, and to open the streets for the purpose. It was currently reported that Counsel was against their claim on all points raised. At any rate, the Corporation immediately apologized to the Directors, and expressed regret for their mistake. They have since, we understand, decided to adopt the electric light; but this, we are informed, has no terror for the Gas Company, who regard it as a friend, creating a demand for light which will "bring grist to their mill."

Now as to the result of the experiment. In the first place, the diffusive power of water gas is very defective; so that while giving an apparently brilliant light in conjunction with ordinary gas, when the latter is taken away its non-diffusive power is very marked. This was the subject of comment during three days when the ordinary lamps were out, and water gas had the lighting all to itself. Secondly, the combs gradually decreased in illuminating power, and had to be changed very frequently. It is impossible to say how many times they were renewed; but, from our correspondent's personal observation at times when the men were seen changing, the average number of hours each comb lasted would not be one-half the time stated. They would, in all probability, have a shorter life if every change could have been ascertained and recorded. Finally, the experiment lasted 76 days. On 9 nights the light was very bright; on 8 nights it was fairly good; on 28 nights bad; on 12 nights very bad; and of the other 19 nights we have no record. It may be well to explain what is meant by these terms. By "very bright," it is to be understood that the two combs were giving a light equal to that afforded by one good ordinary batswing burner consuming 5 cubic feet of coal gas per hour—viz., 16 candles; "fairly good," 14 to 15 candles; "bad," 10 to 13 candles; "very bad," 9 to 6 candles. The American combs were only in use about 25 hours, but they were invariably good.

Reference has already been made to the nuisance attending the manufacture of water gas. Our correspondent heard complaints that the nuisance was very bad on 40 days, and bad on 13 days out of the 76. The effect of exposure in the noxious gas for a short period was first headache, then coughing and sickness, and diarrhœa, more or less severe according to the time of exposure, accompanied by extreme exhaustion and loss of energy. The symptoms varied very much according to age and power of recuperation. Since the plant has been taken down, Parliament Street is, we learn, quite another place, being now airy and sweet.

In September the Mayor invited The British Association and others to dine on his premises, which were lighted with water gas in a most lavish manner, many lamps being apparently well ventilated, so as to prevent nuisance. The cooking was also done by water gas. It was also reported that the smell at Grove House was highly offensive during the meeting, and that the taste of some of the joints was very unpleasant. This remark was made by a stranger from the South, who was accustomed to the freedom from disagreeable taste and smell of his ordinary gas cooking apparatus.

We learn that the Engineer of the Gas Company at the commencement of the experiment requested to be allowed to have a thorough examination of the plant in operation, so that if satisfied with the results, he might purchase it (at a reasonable price) for his Company, and ascertain whether it could be utilized for their advantage as an auxiliary to ordinary gas manufacture; but he had no response to this request, and consequently has not seen the apparatus in work. Judging, however, from the opinions of others who have made an inspection, he does not see that he would derive any pecuniary advantage by adopting the system in its present stage.

Summing up the information furnished by our correspondent, we arrive at the following conclusions:

1. The cost of water gas will be at least double the cost of ordinary gas at the burner.

2. It requires about four times the quantity of water gas to afford the same illuminating power, with the incandescent combs, as would be produced by ordinary gas consumed with batswing burners; and as the various types of incandescent high-power lamps develop nearly three times the light of ordinary burners, it would necessitate the consumption of twelve times the quantity of water gas to equal the illuminating power of these lamps, which are being adopted in Harrogate at several business establishments.

3. The difficulty of dealing with the combs (which do not last half the time stated, with a continuously diminishing light) by ordinary lamplighters is almost insuperable, would tax to the utmost of their ability the resources of the best engineers, and take double the number of lighters, or the same lighters twice the time, besides the adjustment requisite in clipping the wires as the light diminishes, so as to bring the combs nearer to the burners. This clipping was carried on more or less every night during the experiment.

4. The manufacture of water gas is evidently an operation requiring skilled labour, and could not be placed in the hands of ordinary stokers. The gas cannot be purified as it is manufactured, unless purifiers of great magnitude are employed; so, that the crude gas, being made rapidly, is put into the holder, and the purification, if any, is effected as it is delivered from the holder to the consumers.

5. Taking the cost of water gas at the lowest price given by the promoters, and adding the cost of the combs, together with the ordinary expenses of distribution, management, &c., coupled with the fact that about four times the quantity of water gas is requisite to yield a corresponding result to that produced by coal gas, which has been elicited by the Harrogate experiment, it is evident that water gas utilized to heat magnesia combs to incandescence has not the slightest

chance of competing with ordinary coal gas at any place in the United Kingdom.

During the whole period of the experiment, the water-gas lanterns were kept clean daily; but the Corporation lanterns were continuously in a disgracefully dirty and neglected condition. Thus a fair state of comparison was not maintained, as at least one-third of the otherwise available light of the coal gas was lost. Besides, the water-gas lanterns were of the most modern style, with enamelled reflectors carefully ventilated. Nevertheless, these lamps had to be frequently repaired during the experiment, as the great heat from the water gas is very destructive to the glass panes. On the other hand, the Corporation lanterns are of a very old pattern, with no system of air regulation or ventilation, having an open space at the bottom for the lighting-stick, but without any means of closing it. This necessarily causes the flame to be very unsteady. It will thus be seen, as already stated, that the comparison of the two systems of lighting, under such conditions, was manifestly unfair.

The foregoing is the story of the water-gas experiment at Harrogate. It remains to be seen if the corporations of other towns will be led, by its perusal, to give the new gas a trial.

THE SALFORD GAS FRAUDS.

Mr. Mandley Again to the Front.

The judgment of the Court of Appeal in the case of *The Mayor and Corporation of Salford v. Lever* (reported in the JOURNAL last week) has given Mr. J. G. Mandley another opportunity for proposing to bring a motion before the Town Council, this time for the purpose of trying to induce the members to renew the Chancery proceedings against certain of the old contractors to the Gas Department. Almost immediately after the decision of the Court was published, Mr. Mandley forwarded to the Town Clerk (Mr. S. Brown) the notice of motion, which ran as follows: "(*a*) That in view of the judgment of the Court of Appeal in the case of *The Salford Corporation v. Lever*, this Council is now convinced that it is their imperative duty to the ratepayers to take prompt and vigorous action against every contractor or firm of contractors who shall have been charged with having bribed Samuel Hunter, or conspired with him or any other official to cheat the Corporation. Therefore this Council now instructs the Town Clerk to renew the whole of the Chancery proceedings begun against the contractors already incriminated, and also to seek for evidence against every contractor who may be reasonably suspected of a like conspiracy to cheat the Corporation. (*b*) That the said judgment having made it quite clear that the action taken by Mr. George Chesters Haworth, as Chairman of the Ratepayers' Committee, in the Court of Chancery, was a perfectly legitimate and proper proceeding on his part, the costs of the Corporation in the said action be not enforced against that gentleman, but charged to the Gas Department." The Town Clerk handed this notice to the Mayor (Mr. B. Robinson), who, in the course of a letter to Mr. Mandley, wrote: "I have very carefully considered the notice of motion; and in so far as it is made to apply to 'every contractor or firm of contractors,' &c., it must be obvious to you that it is out of order, for the Council have already given a release, under seal, so far as certain contractors are concerned. If you limit your notice of motion to such contractors or firms of contractors as are not referred to or included in the release, your notice will, in my opinion, be in order. As to the second part of your notice, on reflection I venture to think you will come to the conclusion, that the effect of passing such a resolution as contemplated thereby would be to involve the Council in an illegal act altogether." This letter called forth the following reply from Mr. Mandley: "Apart from the fact that the Master of the Rolls has declared the agreement made by the Corporation with the convict Hunter to be *ultra vires*, void, and of no effect, the judgment of the Court of Appeal most emphatically declares that none of the incriminated contractors are shielded from action in respect of their frauds on the Corporation, by the release to which you refer. The Corporation had two distinct causes of action against Ellis Lever; and the release given to Hunter could not be successfully pleaded on his behalf. I know that many sound lawyers believe that my motion is in perfect order; and I earnestly trust that you will not permit yourself to be led to strain your authority by shutting out this motion, to the prejudice of the ratepayers at large, the great bulk of whom I know to be keenly interested in this matter. To limit the scope of my notice of motion as you suggest, would have the effect of protecting certain contractors who have cheated the Corporation far longer and immensely more than the one who was singled out for punishment, Mr. Ellis Lever. For your own fair fame, and for the sake of those whom you represent, I earnestly beg you to give this matter your most careful attention. The remarks of the Master of the Rolls on the Hunter compact have made too deep an impression on the public mind to admit of the idea that nothing further can be done in the matter of the vast frauds in question. As to the legality of the withdrawal of the claim against Mr. George C. Haworth for the costs of the Corporation in the matter of the application for an injunction *re* the release, I am not now in a position to contest the point you raise." A brief answer to this letter was sent by the Mayor, in which he said that, to his mind, Mr. Mandley was clearly in error in both his statements and conclusions; and he therefore saw no reason to alter the opinion expressed in his previous communication.

Derby Gaslight Company.—An extraordinary meeting of the Derby Gaslight Company was held last Wednesday, for the purpose of considering the expediency of raising further capital under the provisions of the Derby Gas Act, 1890. The Chairman (Mr. G. Gascoyne) proposed—"That the Directors be authorized to raise, and may from time to time as, and when, they shall think fit, raise, under the powers of the Derby Gas Act of 1890, in addition to their present authorized capital, any further sums not exceeding in the whole £80,000, by the creation and issue of new ordinary or preference shares and stock, wholly or partially, by one or more of these means respectively." Mr. Richardson seconded the motion; and it was carried unanimously.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

The Half-Yearly General Meeting of this Association was held last Tuesday, at the City Terminus Hotel, Cannon Street, E.C.—Sir JULIAN GOLDSMID, Bart., M.P., in the chair.

The SECRETARY (Mr. R. S. Gardiner) having read the notice convening the meeting,

The CHAIRMAN said he proposed to depart from his usual practice, as he regretted to have to inform the proprietors that the late Deputy-Chairman (Mr. Wood) died on the previous Saturday. This gentleman had been a Director of the Association since 1858, and during the whole of that time he had devoted considerable ability and constant attention to the affairs of the undertaking. He had seen it grow, increase, and prosper, and had contributed much to that growth, increase, and prosperity; and, under these circumstances, he (the Chairman) thought it would be becoming that day, only three days after Mr. Wood's death, if, before taking up the ordinary business, the meeting were to pass a resolution expressing deep sympathy with Mrs. Wood and her daughters, at the great loss which they as well as the Association had sustained. If those present approved of this course, he would move a resolution to that effect.

Mr. NEWTON, as senior Director of the Association, seconded the motion, and it was carried unanimously.

The CHAIRMAN said he would personally communicate the resolution to Mrs. Wood.

The ordinary business of the meeting was then proceeded with.

The SECRETARY read the following report of the Directors:—

The present half-yearly ordinary general meeting of the proprietors has been convened, in conformity with the Association's Acts of Parliament, for the purpose of receiving a report from the Directors upon the affairs of the Company, and of declaring a dividend for the half year ended the 30th of June last.

The following summary shows the results of the Association's operations during that period:—

The quantity of gas made in the half year ended the 30th of June last was 3846 million cubic feet; the quantity made in the corresponding half year of 1889 was 3820 millions—being an increase of 26 million cubic feet, or at the rate of 0·68 per cent.

The total number of lights on the 30th of June last amounted to 1,859,764; there being at that date 134,461 consumers on the books of the Association. At the close of the corresponding half year of 1889, the number of lights was 1,797,512, which gives an increase of 62,252 lights, or at the rate of 3·46 per cent.

The entire length of mains laid on the 30th of June last was 1524 miles; the length of mains laid on the 30th of June, 1889, was 1500 miles—being an increase of 24 miles.

The Association continues to maintain its position, and the Directors are able to report that both the gas-rental and the profit for the half year under review exhibit an advance upon the corresponding period.

There was an increase in the cost of the coal employed during the half year; but, on the other hand, there was a continued advance in the value of the residual products, especially coke and tar.

The plant and mains at all the stations were maintained in a due state of efficiency; and the percentage of gas unaccounted for was again reduced.

The important extensions which are being carried out on the Schöneberg works at Berlin and at Hanover have made good progress. The works in course of construction at Schönweide, near Berlin, for the treatment of the ammoniacal liquor produced at the Association's different works in Berlin, were further proceeded with, and were practically completed. Work is still proceeding upon the gasholder tank at the Tabor works in Vienna, which the peculiar nature of the soil renders longer than is usually the case in similar operations.

Additional land was purchased at Antwerp and Frankfort; and, on the other hand, the Directors have sold land at Aix-la-Chapelle, Ghent, Rotterdam, and Toulouse, which was no longer required for the purposes of the Association.

The Directors have to report that they have obtained a prolongation of the concession for the lighting of the town of Cholet until 1926; and also an extension of the concession for the lighting of Tempelhof, a suburb of Berlin, until 1938. They have also concluded a contract for the lighting of Hainholz, a suburban commune of Hanover.

The Directors desire, in conclusion, to draw the attention of the Proprietors to the accounts for the half year ended the 30th of June last. These have been duly audited, and from them the Directors have, in accordance with the provisions of the Companies' Clauses Consolidation Act, prepared a scheme showing the profit of the Association for the half year, and the portion thereof applicable to the purposes of dividend, which they recommend now to be declared—namely, a dividend of 5 per cent. and a bonus of 1 per cent. for the half year ended the 30th of June last, both payable free of income-tax on and after the 1st day of December next.

The CHAIRMAN, in moving the adoption of the report, said he had just been looking at the report of his speech at the meeting in May last, in order to see that he did not contradict himself in any material point. He observed it was very nearly the shortest speech he had ever delivered; and consequently there was less than usual to give an opportunity of contradiction. But there was one point referred to, to which he looked with some satisfaction, because he found that he stated that the price of coal was very high, and that some alarmists were of opinion that it would be very much higher. Now, he said on that occasion that he thought there might be a permanent increase in the value of coal; but that he did not consider the excessive price then ruling would be likely to continue. As a matter of fact, those prices had not continued; and although coal was considerably higher than it was a year ago, it was not so high as it was six months since—showing, he thought, that everything must reach its level. Though there was a permanent increase, for the reason he would mention directly, he did not believe that the increase was as great as some people feared it would be six months ago. The reason why there must be a permanent increase was, he thought, obvious to everyone; and this was that labour was permanently dearer. The shareholders had seen the accounts of strikes everywhere, and proceedings affecting working men; and in some cases the strikes had had the result of driving trade away from the places affected. Fortunately for the Association, nothing of this kind had touched their operations on the Continent; and he might say this because he thought it of great importance to all employers of labour. As a matter of fact, he told them last time that there had been labour troubles on the Continent, but, as far as

the Association were concerned, they had met them in what he thought was a fair spirit; and the result was that there were no strikes at any of their stations. One of the reasons for this was that they had first of all invariably increased the price of labour whenever they had seen a fair cause for doing so. Some time ago they adopted a system of pensions, the details of which it was not necessary to give, but which was popular with workmen generally, and which had been eminently successful. Therefore, though there would be a permanent increase in the two items of coal and labour, he did not think that, as far as the Continent was concerned, the operations to which he referred would be seriously impeded by any other difficulty. Now, the results of the high price both of coal and labour were not felt much in the period with which the report dealt, because the Association had contracts (of course, beforehand) which extended over a considerable time. The result, therefore, was that, in his opinion, though the present report was so favourable, coming reports might not be equally so, from the simple fact that they might not have the absolutely favourable returns in regard to coal and labour that the report now submitted exhibited. But at the same time the Board had done their best to keep these things within reasonable limits. They had borne in mind that they had three constituents to supply—the public, the municipalities of the towns they served, and the shareholders. He pointed out to them on the last occasion that their Engineers, in the course of the half-year's working then being discussed, had considerably reduced the quantity of gas which was not accounted for. On that occasion he told them that this was something over 5 per cent. Now he found that it was only 4·79 per cent. This figure was so low for a company having stations, large and small, spread over such wide areas as they supplied, that he thought it must be mentioned to the credit of the Engineers who served the Association so well. There was another item referred to in the report, which he thought was eminently satisfactory. It was pointed out that they had upwards of 5000 more consumers than they had a year ago. In some places, 5000 consumers would be considered a splendid *clientèle*, with which some persons would find it difficult to deal; but this was only an addition in six months to the people they served. Therefore, when he stated that the length of the mains had increased by over 24 miles, they would see the magnitude of the operations the Directors had to conduct. He thought they might congratulate themselves on the results of the six months' working; and, in consequence of it, the Directors were glad to be able to recommend the same dividend and the same bonus that they had given during the two previous half years. Since then, one or two things had happened which were interesting to the Association. It was, and had been from the first, their practice (and their contracts sometimes required it) to be represented in all the great towns they served by the agents who belonged to the country and the city they lighted. In Berlin they used to be served by the late Mr. Delbruck, who was a great banker, and one of the great authorities of the city. He represented them for 23 years; but he had recently died, and he (the Chairman) considered it to be their duty, and to the advantage of the Association, to nominate Mr. Delbruck's son to fill the same post. He mentioned this because he thought their agents abroad would be glad to see they appreciated good service from whatever quarter it came. Then there was a fact which affected them from a domestic point of view. The Directors had had to tell the shareholders for three half years past what was no doubt true—that their operations had greatly extended, and that they had more business to do in London, requiring more clerks and more records. Everything had increased; and the offices they had hitherto occupied in Clement's Lane had for a long time past been totally unfit for the work that had to be done. The Directors had thought it right, under these circumstances, to make a change, so as to be able to provide a proper amount of cubic space for their clerks to work in. They had looked for other offices, and they were of opinion that, as he hoped the Association would last for long after those present had all died, it was right that they should have their own office upon their own freehold, if this could be obtained in a suitable position. They had the opportunity of buying a plot of land in Austin Friars. They had purchased it; and they proposed to erect suitable offices where hereafter their business would be transacted. When these were ready, the present offices would be sold; and he trusted that some smaller company might be as prosperous in them as the Imperial Continental Gas Association had been during the last 25 years. He had always told the shareholders what he thought with respect to new inventions—to the progress of anything which affected gas making. He informed them last year of the result of his examination into the question of water gas; and, so far as he saw, it had been more or less borne out—indeed, very much borne out—by facts subsequently elicited. He wished now to say a word or two on another subject which affected the gas interest, and which he believed would have a great deal to do with its work in the future. They were aware that one of the great objects of every inventor was, if possible, to find means to simplify labour. He had told them how every inventor desired to produce a machine which should be able, more or less, to accomplish what manual labour had previously done; and in the gas world there had been inventions of machinery for stoking, and of performing a number of other operations usually accomplished by hand. Hitherto there had been in use two principal systems of furnaces—the ordinary and the generator furnace. There was now a third system introduced in some places, which he thought would, in the future, probably supersede both the others—viz., a system of furnaces with inclined retorts. The result was that coal was supplied to these retorts rather by gravity than by hand labour or by machinery. There were three inventors who, so far, had done something in this matter—M. André Coze, Messrs. Morris and Van Vestraut, and Mr. Alfred Kitt. The process most generally adopted was that of M. Coze; but it was not employed in all works—being rather experimental than general. In his opinion, however, the tendency of improvement in gas-works would be in this direction; and he believed that their own and similar companies might derive considerable advantage from the ability of the inventors. The Directors, like their late colleague, Mr. Wood, were all inclined to take advantage of anything that produced economy and efficiency; and he was sure that every gas company which had interests as large as those of the Imperial Continental Gas Association would not be slow to adopt it. The affairs of the Association were in an excellent condition. Next year there might not be so good a result to show as now, owing to the increase in the price of coal and labour; but the Directors would do their best to present to the shareholders an equally satisfactory record. He concluded by moving the adoption of the report.

Mr. NEWTON, in seconding the motion, referred to the last remark of the Chairman, and expressed his belief, which he thought was shared by others, that practical gas making was not so near its theoretical perfection as the electric light. There were many who were afraid of that light; but he was not in the least.

Professor SYLVESTER asked why the difference was made between dividend and bonus. Was it that the dividend was considered guaranteed?

The CHAIRMAN said the Directors had never made a step in advance unless they had been absolutely certain, as far as anything could be certain in this world, that they would be able to maintain it. When they declared, three half years ago, an additional dividend in the form of a bonus, he distinctly told the shareholders that the state of the business allowed it; but that if, owing to the increase to which he had just referred, which prevented them giving the amount of 1 per cent., they would not hesitate to tell the proprietors, because they thought it much better to face all difficulties at the time, than to veil or conceal them. Therefore, until they were sure, they would continue the principle of paying 5 per cent. dividend and 1 per cent. bonus; and he believed that Professor Sylvester would approve of this course.

The resolution was carried unanimously.

On the motion of the CHAIRMAN, a dividend of 5 per cent. and a bonus of 1 per cent. on £3,800,000 stock on the Association was declared, payable, free of income-tax, on and after the 1st prox.

A cordial vote of thanks having been passed to the Chairman and Directors,

The CHAIRMAN, in acknowledging the vote, said they all did the best they could for the welfare of the shareholders. Many of them had frequently to go to the Continent to visit the stations; and he himself had been to some of them recently. Whatever the Directors did, however, to promote the prosperity of the undertaking would avail little unless they were supported by a good staff; and in the case of their company they had a very admirable one both in London and abroad. He concluded by moving a vote of thanks to these gentlemen.

Mr. PALMER seconded the motion, which was cordially passed, and the proceedings then terminated.

BOMBAY GAS COMPANY, LIMITED.

The Half-Yearly Meeting of this Company was held last Thursday, at the London Offices, No. 6, Drapers Gardens, E.C.—Mr. ROBERT DAVIDSON in the chair.

The SECRETARY (Mr. J. H. Perrins) read the notice calling the meeting; and it was agreed to take as read the Directors' report and the accounts for the half year ending June 30 last, the principal features of which were given in the JOURNAL for the 28th ult. (p. 910).

The CHAIRMAN, in moving the adoption of the report and accounts, congratulated the shareholders upon the very favourable results of the half-year's working, as compared with the corresponding period of the previous year. The sale of gas to private consumers, he said, continued to steadily increase; the consumption for the half year having been, in round figures, 1¼ million cubic feet more—equivalent to 8 per cent. —and producing an increased rental of £771. This amount, augmented by £614 additional income from public lamps, made the additional revenue from gas and meter rental £1385. The residuals had also produced more; but there had been a considerable diminution in the sale of fittings. The consumption of coal for the six months was 5360 tons, at an average cost of £1 15s. 1d. per ton. The cost in the corresponding half of 1889 was £1 12s. 9d.; so that there had been an advance of 2s. 4d. per ton. The difference would have been greater, had it not been for the fact that the Company had a considerable quantity of coal in stock at the commencement of the half year. At the previous meeting he intimated that the advance in the price of coal would largely affect the expenditure; and, as the shareholders would see from the Directors' report, this statement had been fully borne out—the large increase in the cost of carbonizing being chiefly due to this cause. The item of salaries showed an increase of £208. The Company's Manager was paid partly by salary and partly by commission on the sale of gas; and this increase represented additional commission earned. The shareholders would observe that a larger sum had been written off revenue for depreciation of stocks. With these exceptions, all the other items of expenditure exhibited very satisfactory reductions. As to exchange, the rate at which their funds were remitted home during the half year was 1s. 5⅝d. against 1s. 4 11/16d. in the corresponding period—thus showing an improvement of about 5/16 per cent. The rate now current was 1s. 7d.; and on the whole he was disposed to look for some advance on this in the next few months.

Major W. F. GORDON seconded the motion.

Mr. H. E. JONES, referring to the diminution in the sale of fittings, asked whether there was any means of showing how it arose, consistent with the increase in the number of consumers, or in the sale of gas.

The CHAIRMAN said that the number of consumers and the receipts for gas went on improving; but he supposed the fittings had been of a cheaper class.

Mr. CUFF remarked that the accounts seemed to be very satisfactory on the face of them; and he presumed, with the increased price of silver, their prospects were good. Alluding to the item in the profit and loss account "written off stocks, &c., £875," he asked if the Chairman could inform the shareholders which stocks this amount had been written off.

The CHAIRMAN replied that they had not written anything off the stock of fittings for a considerable time. On this occasion, however, they had written £400 off meters; £200 off chandeliers; £65 off fittings on hire; and a sum of £203 for services renewed. Replying to further questions, the Chairman stated that the whole of the revenue in Bombay had been remitted to England at 1s. 5⅝d. per rupee. The

item of £7224 in the profit and loss account, represented the loss incurred in bringing home the whole of the revenue of the half year—in fact, they had remitted rather more than the half-year's revenue.

The motion was unanimously carried.

The CHAIRMAN said he thought the shareholders who were in the habit of attending the interim meetings of the Company—those held in November—could not have failed to observe the small number of shareholders usually present; and the Directors had, in consequence, for some time had under consideration the propriety of dispensing with them. The Articles of Association made provision for only one meeting in each year; and empowered the Directors to declare an interim dividend, so that there was really no business to be transacted at these meetings. They also believed it would be more satisfactory to place before the shareholders the result of the whole year's working. This course would save the officers of the Company both at home and in India a great deal of unnecessary labour and some expense. They therefore proposed in future to discontinue the interim meeting; and he trusted the step would have the entire concurrence of the shareholders.

Both Mr. JONES and Mr. CUFF spoke in support of the proposal; and no one dissenting, the CHAIRMAN thanked the shareholders for the unanimous way in which they accepted the views of the Board.

Mr. ADAMS said he noticed in the accounts that £30,000 had been sent home at 1s. 5¾d.; and he asked whether this was not an unusual sum to remit in one half year.

The CHAIRMAN replied that, when they had this money home, compared with what they had been getting, the rate of exchange was very satisfactory. Subsequently, however, the exchange went up to 1s. 9 1/16d.; and now it had gone down again to 1s. 6¼d. £30,000 was about the normal sum they remitted.

Mr. JONES moved a vote of thanks to the Chairman and Directors; and in doing so, he said that, as a young shareholder, he was struck with what must be the difficulties of the Board administering a concern 3000 miles away, and with a large amount of capital. He proceeded to urge the Directors to do their utmost to reduce the price of gas, and so place it on a more attractive footing.

Mr. R. KING seconded the motion, which was unanimously carried.

The CHAIRMAN having briefly replied, the proceedings terminated.

AUSTRALASIAN GAS ASSOCIATION, LIMITED.

The Second Annual Meeting of this Association was held last Thursday, at the London Offices, Suffolk House, Laurence Pountney Hill, E.C.—Mr. H. L. HAMMACK in the chair.

The SECRETARY (Mr. G. J. Gray) read the notice convening the meeting; and it was agreed to take as read the Directors' report and accounts, to which brief reference was made last week (p. 955).

The CHAIRMAN, in moving the adoption of the report and accounts, said that he thought the shareholders had reason to be exceedingly satisfied with the progress which had been made during the year. Deducting the interim payment to the proprietors, there was a balance of revenue of £1473 available for dividend. He was glad to say that three-quarters of the amount paid away as dividend went to people in England, and one-quarter to people in Australia; and this indicated that the latter had confidence in the undertaking. The capital subscribed in 1888-9 was about £38,000; and at June 30 last, £47,550. Australia had since subscribed £2600, and England £2000—making a total capital of £52,150, as compared with £38,000 at the time of the last meeting. The expenditure on works in 1888-9 was £33,341; and at June 30 last, it was £58,808—being an increase of £25,467, which money had been very judiciously expended. They had acquired a valuable property at Box Hill, a growing suburb of Melbourne. There was every evidence of success at this station; and arrangements had been made with the Railway Commissioners to light four railway stations from these works. The outlay for the works (£12,383) would at once prove a most profitable investment. In addition to this, they had opened their Sandgate works, upon which they had spent £7800. Sandgate was near Brisbane, the capital of Queensland, and was a very promising station. The receipts for gas and residuals in 1888-9 amounted to £3537; and their investment in the Charters Towers Gas Company gave them a dividend of £160—together an income of £3700. This year the amounts were respectively £6565 and £160—making £6725, which was an increase of £3100. Their investment in the Charters Towers Company returned them more than 10 per cent.; and he believed what that Company were doing, their own would shortly be able to accomplish. He proceeded to refer to the economical manner in which the Company was managed; and then stated that the net revenue balance at June 30, 1889, was £1335, and for the past year it was £2665. The shareholders, he thought, would agree that the efforts of the Directors had resulted satisfactorily. He was, however, sorry to say that they had had to borrow money; but they stood in such good credit, that they had obtained it on fair terms. They had still some unissued capital; and he asked the shareholders to introduce the Company to the notice of their friends, seeing that it provided a good 7 per cent. security. He also alluded to the strike in Australia, which, he was pleased to learn from that day's papers, had now been terminated. In conclusion, he spoke in terms of praise of the services of the Company's staff in Australia, and of the successful way in which they had encountered the many difficulties which had recently beset them.

Mr. W. C. PARKINSON seconded the motion, and observed that it was rarely that one found a new Company started—especially with a collection of small concerns—such as theirs, which was able to pay so satisfactory a dividend at such an early date. The Directors were very satisfied with what had been done up to the present time; and the advices which they received assured them that the whole of their works were progressing in a very gratifying way. Not only had the Directors confidence that the dividend would be maintained in the future, but they had every hope that it would be increased.

The motion was unanimously carried.

The CHAIRMAN proposed, and Mr. S. SPENCER seconded, the declaration of a dividend for the half year ending June 30 at the rate of 7 per cent. per annum in proportion to the amount paid up on the several shares.

The proposition having been carried,

Mr. Parkinson, who retired from the Board by rotation, was re-elected, on the motion of the CHAIRMAN, seconded by Mr. G. H. HAYWOOD; and Mr. Spencer was likewise re-elected, on the proposition of Mr. HAIGH, seconded by Mr. WALKER.

On the motion of Mr. CHUBB, seconded by Mr. HAIGH, the Auditors (Messrs. Alfred Lass and Co.) were unanimously re-appointed.

Votes of thanks were then passed to the Chairman and Directors, to the Australian Committee (of which Mr. John Coates is a member), and also to the officials; the name of the Manager, Mr. G. Swinburne, being specially mentioned in connection with the latter.

The CHAIRMAN, in acknowledging the confidence of the shareholders, stated that the Directors had each a substantial stake in the concern.

The proceedings then terminated.

GEORGETOWN (BRITISH GUIANA) GAS COMPANY, LIMITED.

The Half-Yearly General Meeting of this Company was held last Tuesday, at the London Offices, No. 30, Gracechurch Street, E.C.—Mr. ALFRED WILLIAMS in the chair.

The SECRETARY (Mr. Alfred Lass, F.C.A.) having read the notice of meeting, the Directors' report, and the statement of accounts for the half year ended June 30 last were taken as read (see *ante*, p.910).

The CHAIRMAN, in moving the adoption of the report, said he believed that the shareholders who had read the balance-sheet would have come to the conclusion that it was a very satisfactory one. An increased profit had been made; but the Directors had not thought fit to propose the declaration of a larger dividend, as they wished to have money in hand with which to meet the extra cost of coal. Therefore they recommended a dividend at the same rate as before. In the report was mentioned the lamentable fact that the Company had lost (by death) their respected Director at Georgetown, Mr. R. P. Drysdale; and, with regard thereto, he remarked that correspondence was now proceeding with the object of appointing another gentleman in his place.

Mr. CHARLES GANDON seconded the motion; and it was unanimously carried.

On the proposition of the CHAIRMAN, seconded by Mr. GANDON, dividends were then declared for the half year ended June 30 on the preference share capital at the rate of 8 per cent. per annum, and on the ordinary share capital at the rate of 7 per cent., both less income-tax (except on dividends payable to local shareholders).

The CHAIRMAN then moved that the best thanks of the meeting be given to the Secretary (Mr. Lass) the Local Secretary (Mr. F. A. Conyers), the Engineer (Mr. T. B. Younger), the Auditors (Messrs. King and Berridge), and the Solicitor (Mr. E. K. Blyth), for the services they had rendered to the Company during the half year.

Mr. ROBINS seconded the motion, which was agreed to.

Mr. BLYTH having suitably responded on behalf of the officers,

Mr. ROBINS asked whether some means could not be devised by which the proprietors could more easily buy and sell the Company's shares, seeing that they were not quoted on the Stock Exchange. He was an original shareholder, though only to a small amount; and he should have liked to have increased his holding or disposed of the shares he held, but he had not been able to do either.

The CHAIRMAN said, the Company being small, the market for the shares was really only a private one; but shares paying 7 per cent. would never go begging in these days. The Board seldom heard of the shares being for disposal unless it was through death.

A vote of thanks having been passed to the Chairman and Directors, the proceedings terminated.

Fraudulently Using Gas at Morecambe.—At last week's sitting of the Lancaster Magistrates, William Baynes, a plumber and lodging-house keeper, of Morecambe, was charged with fraudulently using gas by laying a pipe and connecting it with a pipe of the Morecambe Gas Company; and he pleaded guilty. It was stated that, when an inspector of the Company visited defendant's premises, he found the service and supply pipes uncoupled from the meter, and that a pipe of his own had been coupled with the service-pipe, from which a supply of gas was obtained without passing through the meter. Defendant was ordered to pay a fine of £2 10s., and £1 1s. 6d. costs.

The Combination of Local Authorities for Electric Lighting Purposes.—Last year the Corporation of Kingston, the Surbiton Improvement Commissioners, and the Hampton Wick Local Board combined to make an application to the Board of Trade, for powers to light their respective districts by electricity. The application, however, came to nothing, as the Board of Trade had no power to grant a Licence to two or three combined authorities. Profiting by their experience of last year, the three authorities concerned met and considered the matter; and the result was that, at the meeting of the Kingston Town Council last Thursday week, the General Purposes Committee recommended that an application be made for a Provisional Order. This was agreed to. It was explained that the object the Committee had in view was to prevent any Company obtaining powers, and so taking the matter entirely out of the hands of the Corporation.

Northern Coal Trade.—There has been a quietness in the coal trade of the north as a whole during the past few days; but gas coal has been rather scarce owing to one or two pits having been laid idle through temporary causes. Northumbrian steam coals are dull at 11s. 6d., though one or two collieries ask rather more. Small steam are quiet at 6s. to 6s. 3d., also free on board. For bunker coals the demand is quiet at from 9s. to 9s. 6d. free on board. Gas coals vary in price a good deal. It is understood that the contract has been fixed for the supply of coal for the North Shields Gas-Works—about 30,000 tons for next year; and the statement current is that the price is less than 10s. 9d., which is lower than the previous large contract, so that a falling off in the anticipation of some of the coalowners is evident. For cargoes of best gas coal, the price required varies from 11s. to 11s. 6d. free on board, less discount. Coke is firmer; and for best blast-furnace qualities £1 per ton free on board is asked. Gas coke is unchanged.

GAS APPLIANCES AT THE FOOD AND COOKERY EXHIBITION.

Last Wednesday, the second International Food and Cookery Exhibition was opened at the Agricultural Hall, Islington, and it will continue open till the end of the present week. Gas has for a long time played an important part in the cooking of food; and it is a matter of much interest to witness the daily competitions that are taking place at this exhibition between the scholars of the London School Board. No less than twelve dishes are prepared; and fifteen girls are tested at two stands, each of which is fitted with a couple of Sugg's enamelled gas cooking-stoves. Besides having a full knowledge of the ingredients with which they deal, the competitors are, very properly, also instructed as to the use of the cooking-stoves. At the farther end of the Hall, Miss Kelman (who has been specially engaged by the exhibition authorities) gives twice daily demonstrations of the use of gas cooking-stoves; using alternately the various makes of these appliances now in the market.

Turning to the exhibition itself, we find several well-known firms who apparently spare neither trouble nor expense in demonstrating the value of their wares. In the arcade, Mr. F. H. Vigne, of 57, Chancery Lane, has an effective show of the new Douglass gas-burners, which are on the principle of the lighthouse burners of this type. They work very steadily, and give a most powerful light with a small consumption of gas. The "Lux Calor" gas-stove is also exhibited by Mr. Vigne. At stand No. 7, the Volcanic Aëration Company are using three of Sugg's regenerative lamps with good effect. At No. 32, Messrs. H. and C. Davis and Co., of Camberwell, take the lead in an assortment of gas grillers, plates, boilers, heaters, stoves, &c. At stand No. 42, Messrs. John Wright and Co., Limited, of Birmingham, exhibit a large selection of gas cooking and heating stoves, noticeably their patent enamelled steel-lined "Eureka" gas cooker. At stand No. 59, Mr. W. Booth, of Richmond, introduces the patent grip for connecting all kinds of tubes for gas and water. This is an exceedingly novel invention, and prevents rubber tubing slipping off any connection. At stand No. 74 there is the usual assortment of specialities by Messrs. T. Fletcher and Co., of Warrington; the stoves when lighted producing a brilliant effect. At No. 78, Messrs. J. Stott and Co., of Fleet Street, show their well-known gas-governor. Another fine display is that of Messrs. H. Darwin and Co., of the St. Andrew's Works, Glasgow, who exhibit their patent gas heating-stoves and gas-fires. The appearance of these articles is attractive, because, besides being Berlin-blacked, they are also electro-bronzed or brassed. They are fitted with a new Bunsen burner called the "Darwin patent silent jet;" and the stove is the nearest resemblance to a coal fire yet made. A splendid exhibit is that of Messrs. R. and A. Main, of No. 90, Hatton Garden, who have a good assortment of their patent enamelled steel gas cookers, as well as gas-fires with fibre asbestos, and ball fuel. The only two gas-engine manufacturers are Messrs. Dick, Kerr, and Co., of Queen Victoria Street, and Messrs. Crossley Bros., of St. Bride Street. The best show of the whole is upstairs, in the Prince's Hall, where Mrs. Page lectures on cooking for The Gaslight and Coke Company. There are arranged in this place all the styles of gas-stoves by the firms already mentioned, besides those of Messrs. W. Sugg and Co., Limited, of Westminster. These lectures, we are glad to know, are being well attended. At the approach we note the special exhibits of gas-regulators by Messrs. Slatter and Watkins, of Little Marlborough Street, and the geysers by Messrs. Ewart and Son, of No. 346, Euston Road. Altogether, the exhibition fairly deserves its name; but it does not come up to that held two weeks ago in the same place.

Heywood Corporation Gas Supply.—At their last meeting for the past municipal year, the Heywood Town Council adopted the minutes of the Water Committee, which contained a resolution to the effect that intimation be conveyed to the Rochdale Corporation that, as the approaching completion of their new water-works placed the Heywood Corporation in a position to meet the requirements of the district, the Committee desired to terminate the agreement of July 10, 1884, from the end of the present year, and also to place upon record their appreciation of the valued assistance in the matter of water supply rendered to the Corporation by Rochdale during the droughts of 1884, 1887, and 1888, which proved alike beneficial to both Corporations.

The Ennis Gas Company Fined for Breach of an Agreement.—Last Friday week, an action was tried at Ennis in which the Town Commissioners claimed £10 damages against the Gas Company by reason of their failing to fulfil a certain contract or agreement with them for lighting the town. The breaches of the agreement were alleged to be the substitution of smaller burners in five of the public lamps than those contracted to be supplied, in consequence of which the illuminating power was not up to the standard agreed upon. Evidence having been given by, among others, Mr. W. J. Wynne, late Manager of the Company, and Mr. P. J. Baker, the Engineer to the Limerick Corporation Gas Committee, in support of the case for the Commissioners, Mr. W. Harding, the Manager of the Company, was examined, and admitted that the burners had been changed. His Honour (Mr. C. Kelly, Q.C.) gave a decree for £5 5s.

The Leamington Corporation and the Electric Light.—At a meeting of the Watch Committee of the Leamington Corporation last Wednesday, a letter was read from Messrs. Chamberlain and Hookham, of Birmingham, the contractors for the supply of electric light in the town. At the previous meeting of the Council, the Borough Surveyor reported that he had made tests of the light in the presence of a representative of the Company. At that meeting some remarks were also made in regard to the character of the light supplied; and the Council instructed the Town Clerk not to pay the account then due. Messrs. Chamberlain and Hookham now demand 5 per cent. on the unpaid account, and give the Corporation six months' notice to terminate the contract. They dispute the accuracy of the Surveyor's report regarding the tests, and add that they intend to apply for a Provisional Order to light the town. The letter was on the *agenda* for discussion at the meeting of the Council yesterday.

ABERDEEN CORPORATION GAS SUPPLY.

Increase in the Price of Gas.

As mentioned in our Edinburgh Correspondent's "Notes" last week, the Town Council of Aberdeen had before them at their last meeting the accounts of the Gas Department for the year ending the 30th of September. The revenue was reported to have amounted to £62,648, of which the following were the chief items: Gas, £52,891; meters, £17; coke, £3989; tar and ammoniacal liquor, £5558; and stoves, £187. The expenditure was £58,388. The principal items were: Coal, £26,693; wages of stokers and labourers, £6315; maintenance of plant, &c., £2336; distribution, £2653; West's patent stoking machinery, £3375; rents, rates, and taxes, £4192; management expenses, £1370; discounts and bad debts, £1686; and depreciation, sinking, and contingent funds, £8286. This left a balance of £4259, of which, together with a balance from last year of £5401, it was proposed to dispose as follows: Annuities, £5416; interest on mortgages, &c., £1847; reserve and fire insurance fund, £300; electric lighting, expenses of Provisional Order and Bill, £742—leaving £1355 to be carried to next year's account, to be applied towards providing new stoking machinery. The capital account, which at the end of the previous year stood at £136,918, was reduced by £6385. The contingent fund amounts to £27,450; the sinking fund to £19,895; and the reserve and fire insurance fund to £7831. The quantity of coal carbonized during the year was 32,968 tons; the average price of which was 16s. 2¼d. per ton. From this 337,886,000 cubic feet of gas were made, or 10,732,000 cubic feet more than in the previous year; and the unaccounted-for gas amounted to 8·61 per cent., as against 8·46 per cent. The net gas-rental came to £52,891—an increase of £1691; the bad debts being put down at £315 6s. 9d., as against £359 1s. 7d. in the previous year. The Gas Committee recommended that the price of gas be raised from 3s. 6d. to 3s. 8d. per 1000 feet.

Mr. COLLIE, the Convener of the Gas Committee, moved the adoption of the accounts and the recommendation. In doing so, he said the quantity of gas made during the year was 337,886,000 cubic feet, of which there had been sold 308,876,900 feet. The loss by leakage was 29,009,100 cubic feet, or equal to about 8½ per cent. There was an increase on the coke and tar account of £1700. The total revenue from gas was £62,648, or £1200 more than in the previous year. There was an advance of £500 on the wages account, and £1700 on the coal account. The latter was explained by a greater quantity having been used, and an increase in price. Meters had cost about £1200 more. A payment of £3375 had been made on West's stoking machinery, and £1355 would be carried forward to meet the balance for machinery. The capital account was rapidly coming down, the total amount of the expenditure being upwards of £214,000; while £84,000 had been written off—leaving the value of the undertaking at £130,500. at the same time laying up a reserve fund of £7800. The works were capable of producing more than three times the quantity of gas turned out in 1871. The estimates for the ensuing year had been made up with much care; but it had been found necessary to raise the price of gas 2d. per 1000 cubic feet. They were not alone in this respect. Edinburgh had had to advance the price 3d., and Dundee had also raised it 3d. The Committee were unwilling to resort to an increase; but they must pay their way. He fully believed it would only be temporary, especially if coal came down in price; and he expected the stoking machinery to show a great saving. It should have been ready last May; but, being a new thing—the first in Scotland—alterations had to be made to suit their coal.

Baillie DUFF seconded the motion.

Mr. GORDON moved, as an amendment, that the price of gas be continued at the present rate. He thought it was too bad to raise the price at this time, considering that the value of the gas-works was put at the same as last year, notwithstanding that during the year they had added £3355; and, not only so, but had paid £1382 for depreciation. In fact, they had paid about £8000 in all. He did not think it was a wise thing to make the present gas consumers pay for those of the future.

Mr. FINDLAY seconded the amendment.

Mr. M'KENZIE, while greatly sympathizing with what had been said by Mr. Gordon, remarked that for the next year, and for years to come, the Committee would have to face a very considerable rise in the price of gas coal. He thought, therefore, they had done a wise thing in proposing to raise the price of gas slightly now, and avoid the risk of having to make a big rise next year.

The LORD PROVOST said that last year they had a credit balance of £5499; but they had to pay out of it £3375 for West's machinery, and £742 for electric lighting—making together £4117. They had reduced their previous year's balance by £4046; so that they had not to pay a penny of it practically out of last year's income. He did not see any help for it but to raise the price of gas 2d. per 1000 cubic feet; and he would be very glad if they had not to increase it next year.

Mr. ANDERSON said they were told that the coal purchased would produce gas of about 25-candle power. Was he to understand that this was the quality of gas that was to be produced and supplied to the inhabitants during the next twelve months; and that for this quality of gas they were to pay an advance of 2d. in the price? Then, again, they were told that the average price of the coal was 18s. 10d. per ton. Supposing it was 19s., and they purchased the 30,000 tons which were contracted for, he failed to see how it could come to £32,000. This was at least £3500 more than the contract price of the coals.

Mr. COOK thought they were entitled to spread the £742 of expenses in connection with the electric lighting scheme over a longer period than one year. He suggested that they should remit back to the Committee the question whether they should raise the price of gas 2d. per 1000 cubic feet, or whether they should not rather see how to tide the thing over, and temporize the electric lighting expenses.

Mr. SMITH (the Gas Manager), in reply to Mr. Anderson, said the 30,000 tons of coal would not have produced 310 million cubic feet of gas. They had 5000 tons of coal in stock above that; and this was really how the cost of the coal came up to £32,000 to produce the 310 million cubic feet o gas.

The motion was eventually agreed to by 15 votes to 5.

ELECTRIC LIGHTING SCHEMES IN LONDON.

Commencement of the St. Pancras Station.

Our readers are aware that the St. Pancras Vestry have decided to keep in their own hands the electric lighting of the parish; and some time ago they secured the services of Professor H. Robinson, M. Inst. C.E., to prepare a scheme for them. His recommendations having met with the approval of the Vestry, a site was secured in Stanhope Street, Euston Road, on which to erect the necessary plant; and last Wednesday afternoon a start was made by the laying of the foundation stone of the buildings which will constitute the first central station. This ceremony was performed by Messrs. A. Boden and N. Robinson, Churchwardens, in the presence of a large assembly.

Professor Henry Robinson (the Electrical Engineer to the Vestry) stated that the installation now being carried out by the Vestry under his direction would supply the south-western part of the parish, and was intended to be followed by further stations to serve the rest of the district if the results were proved to be as satisfactory from a commercial standpoint as was anticipated. He had adopted the continuous current, and had fixed the electro-motive force at 110 volts to suit incandescent lamps. The mains would be laid on what was known as the "three-wire" system, by which arrangement the current is transmitted from the central station at 220 volts along the two outside wires, while the third wire is kept at an intermediate potential differing from that of either of the outside wires by 110 volts. The lamps are in electrical contact with either of the outer wires and with this third wire. Half the lamps are connected to one outside wire and half to the other. In the event of the demand being greater on one side than the other, it is met by a supply from the station along the third wire. This arrangement enables current to be sent out at 220 volts for purposes of motive power and arc lights, in addition to the supply at 110 volts for incandescent lighting. This is, in Professor Robinson's opinion, by far the most efficient and economical system of distributing electrical energy under conditions which obtain in St. Pancras. The central station plant will be capable of supplying low-tension current to serve 10,000 incandescent lamps of 16-candle power simultaneously, and at the same time high-tension current will be provided on a separate set of mains for the public lights in the streets, to the extent of 90 10-ampère arc lights, or a larger number of lamps of equivalent candle power. At the outset, there will be nine low-tension, and two high-tension dynamos; one of each sort being held in reserve. All the dynamos will be driven direct by triple-expansion condensing engines. There will be six sets of accumulators, capable of serving 800 or 900 lights, to work all the lamps in use at periods of minimum demand, when the engines and dynamos would not be working; and they will further act as an additional reserve. To commence with, provision is made for 5 miles of distributing mains, which are designed to carry current for 25,000 incandescent lamps of 16-candle power in use simultaneously, and separate mains are provided for the street lighting. The parish of St. Pancras now remains intact in the hands of the Vestry for the purpose of distributing electrical energy, under a Provisional Order obtained in 1883. No company has as yet succeeded in getting powers within the area. Professor Robinson congratulated the Vestry and the ratepayers on being in this unique position in the Metropolis, as he was quite confident time would show that a wise course had been followed in keeping the supply in their own hands.

After the ceremony, a vote of thanks to the Churchwardens was proposed by the Chairman of the Electricity Committee (Mr. Andrew Sweet). In doing so, he stated that the estimated cost of the works then begun was £55,000, which it was proposed to borrow at 3½ per cent. from the County Council—the payment of principal and interest to be spread over 42 years. At a very moderate computation, supplying the light at 6d. per unit, as against 8d. charged by private companies, he confidently anticipated that they would derive a yearly income which would yield them 20 per cent. upon the capital outlay.

ELECTRIC LIGHTING FOR CROYDON.

A Report by Mr. W. H. Preece.—Some Fascinating Figures.

By an overwhelming majority, the Croydon Town Council have adopted a recommendation of the General Purposes Committee that they make application for a Provisional Order, giving them powers to supply electric lighting in the borough. The Committee based their proposals on a report prepared by Mr. W. H. Preece, which contained figures which the Committee do not—at least so far as the private lighting is concerned—think are too sanguine; in fact, the Chairman of the Committee, Mr. Miller (who, by the way, is a draper, and not an electrician), believes they will do better than Mr. Preece imagines. Some comments on the report appear elsewhere to-day; and the following are its salient features:—

The report commences by stating that the district to be served is so scattered that there is only one system of electric lighting that it is possible to introduce with any prospect of success, and that is the high pressure alternate current system, "which has been so extensively used in London and the provinces." By this system it would be easy to establish a central station at the water-works, and from thence to generate and distribute sufficient electrical energy to serve the whole district. It would be necessary for purposes of distribution to establish sub-stations at Upper Norwood, South Norwood, Thornton Heath, and South Croydon. These sub-stations would simply contain transformers for lowering the electrical pressure, so as to distribute the current over the area to be served at a safe pressure. The electrical energy would be carried in underground mains between the central station and these sub-stations; and from the sub-stations it would be distributed partly underground and partly overhead. There is, Mr. Preece remarks, so much difference between the prime cost of underground work and of overhead work, that it is not economical to use other than overhead lines through the sparsely inhabited roads in the outlying districts. He proposes to replace the whole of the 1781 gas-lamps by electricity. Taking the population of the borough at 100,000, he estimates from past experience, that the Council might consider that ultimately 30,000 lamps would probably be installed and used in the district. To work these it would be necessary to employ a capital of £150,000; but the introduction of these lamps would necessarily be a slow operation. People, he admits, are very cautious in taking the electric light; and therefore, he does not think it would be necessary at first to call up a larger capital than £50,000, nor that during the first two years the Council could reckon upon fixing more than the equivalent of 6400 standard electric lamps, made up as follows: For public lighting, 3400 lamps; for private lighting, 3000 lamps—a total of 6400. Experience in other districts has shown, says Mr. Preece, that the Council might fairly estimate a revenue of 24s. 6d. per lamp per annum for private lighting; and as they are already paying £6187 per annum for public lighting, he believes that they could regard this sum in the shape of revenue. He estimates for revenue—

3000 private lamps (at 24s. 6d.)	£3675
Present cost of public lamps	6187
Total	£9862

He calculates that the working expenses would be 18s. per lamp per annum, which represents for the 6400 lamps a charge of £5760. The Council would thus have a balance of £4102 to pay interest on money borrowed, and to go towards the reduction of the present rates. The public lighting, the report proceeds, would be much more efficient than at present. The electric lamps actually used would not be the standard lamps of 16-candle power, but mostly lamps of 32-candle power, and in some cases perhaps lamps of 50-candle power. Altogether the public lamps would be equivalent to 3400 standard lamps. For private lighting, the number of lamps installed per house averages 40; but the number maintained alight averages only 20. In his opinion it would be better to take 20 for estimation. This would mean that the 3000 lamps would be taken up by 150 houses; and this was the basis upon which the above estimate had been formed, and he did not think it was too sanguine. From present experience the electric light, says Mr. Preece, can be supplied as cheaply as gas. It may be paid for either by meter or by contract. He bases his estimate on the assumption that the Council will charge by meter 7d. per Board of Trade unit; being ½d. per unit less than that charged by the London companies. He also adds that it is not advisable to commence too cheap a supply. If the system extended, it might be found possible to reduce the price; but at the first starting of such a district as Croydon, 7d. was as low a rate as the Corporation would be justified in charging. While recommending that a Provisional Order should be applied for, empowering the Corporation to light the whole of the borough with electricity in accordance with the report, the General Purposes Committee have defined a "compulsory area" in which the lighting is to be carried out within two years.

Buenos Ayres (New) Gas Company, Limited.—A half-yearly dividend at the rate of 6 per cent. per annum has been declared by the Directors of this Company.

The Argentine Gas Company's Works at Buenos Ayres.—In the article on the gas supply of Buenos Ayres which appeared in the JOURNAL last week, reference was made to the improvements carried out in the above-named works under the direction of Mr. W. B. Whitaker, Assoc. M. Inst. C.E. The new plant with which the works have been furnished comprises condensers, scrubbers, &c., supplied by Messrs. R. Dempster and Sons, Limited, of Elland.

Underground Pipes and Wires in the Metropolis.—At a recent meeting of the Strand District Board of Works, a proposal that subways should be made for holding the pipes and wires of the gas, water, and electric light companies in the district was discussed; and the matter was referred to the Works and Parliamentary Committee with a view to united action being taken. It is understood that a memorial will be promoted by all the local authorities in London to induce the County Council to bring a Bill into Parliament next session dealing with the subject.

Glasgow Corporation Water-Works.—An important portion of the Glasgow water-works extension was formally opened on the 31st ult. The section consisted of a tunnel 1¾ miles long. It is intended for the passage of 70 million gallons of water daily. The existing tunnel passes 40 million gallons. The height of the new tunnel is 10 feet by 12 feet, as compared with 8 feet by 3 feet, the size of the present tunnel. The new works will rather more than double the means of water supply for the city. The cost of this section of the work has been £40,000. The total length of the series of aqueducts between Loch Katrine and Glasgow is 23¾ miles. Of this distance, 13¾ miles have been contracted for; the aggregate amount of the existing contracts being upwards of £500,000. Arrangements have not yet been made for carrying out the remaining 10¼ miles. The amount of the contracts will bring the total to upwards of £1,000,000.

Gas-Heated Baths.—Writing as to the dangers of hot-water geysers, the *British Medical Journal* recently made the following remarks: "As a rule the apparatus is sent out without a flue; nearly all the manufacturers appearing to think that gas products, being invisible and colourless, may safely be left to diffuse in the air of a bath-room. From numerous experiments we have conducted, it will be readily seen that such is not the case. To heat 30 gallons of water from 50° Fahr. to 100° Fahr. requires, on an average, the consumption of 30 cubic feet of gas; the time taken to heat the water varying from 15 to 40 minutes, according to the size of the geyser and the number of gas-jets. Now, 30 feet of gas produce on combustion 60 feet of carbonic acid. A good-sized bath-room is one 10 ft. by 10 ft. by 5 ft., containing 500 cubic feet of space; so that if no flue to the outer air is provided and the window and door are kept closed, 60 cubic feet of carbonic acid diffusing in 500 cubic feet of air causes the carbonic acid in the air to reach the enormous amount of 12 per cent. From 5 to 10 per cent. of carbonic acid in the air is the amount usually stated to be productive of fatal results, by rendering such air irrespirable."

WEST MIDDLESEX WATER-WORKS COMPANY.

The Half-Yearly General Meeting of this Company was held last Tuesday, at the Offices, Marylebone Road—Sir W. H. WYATT in the chair.

The SECRETARY (Mr. G. B. Hall) read the notice convening the meeting, and the Directors' report and statement of accounts were taken as read. He afterwards read the Auditors' report, which stated that the revenue for the half year ending at Michaelmas last was £115,173, or an increase of £2807 as compared with that of the corresponding period of the previous year; and that the balance to the credit of the dividend and interest account was £147,033.

The CHAIRMAN said he thought the report and accounts sent to the shareholders on this occasion were certainly, without exception, the most satisfactory that it had ever been the privilege of the Board to submit to them. The financial position of the Company was never so strong as now. An unsatisfactory thing, of course, on the other hand, was the attack made in the desire to wrest from them their most excellent and secure property. He would not, however, say much as to this matter then, because he knew very little about it; and therefore the less he said, the better it would be. He now came to the various subjects touched on in the report. The Worthington engine at Hammersmith had been completed; and when he told the shareholders that there was every reason to hope that they would save as much in coal as the interest on the cost of it, besides doing very good work for them, he thought it would be highly satisfactory. All the works, according to their Engineer, were in an excellent state. A small district in Paddington had been put on the constant service; and the Directors had agreed, at the request of the London County Council, to give voluntarily a constant supply to all those tenants who would put their fittings in a condition to receive it. They did this readily, for they were not obstructionists. As to the quinquennial valuation, the way in which all the parishes were raising their assessments was most serious. They were increasing the rates of the companies in a manner that was extremely unfair. If they were not too exacting, the Company submitted. But there were, he thought, three cases where they could not do so; and they were going to appeal. The Directors had been asked to send a representative to the Committee appointed by the Corporation of London to inquire into the subject of the water supply of the Metropolis. But as this Committee was entirely self-appointed, and had no more power to investigate the matter than he had, the Directors felt it was of no use going before the Committee and doing nothing. All the Water Companies therefore declined the invitation. The Committee had since issued their report; and the whole course of their procedure showed the greatest partiality. Before they commenced they wanted to arrive at one conclusion; and they did their best to do so. The evidence was not given on oath, and there was no solemnity about it. Much of it was as contrary to fact as it could possibly be. Since the close of the inquiry, the Directors had had a different sort of request from the London County Council. Now, the Council was in some degree an Authority—that was to say, they were empowered by Parliament to hold an inquiry on the water question, in connection with which they might spend £5000. They could not, however, do anything more; they could simply have the inquiry and make known the result. They first of all asked whether the Water Companies would meet them to see if they could come to some provisional terms. But as the Council had no authority to purchase, the Companies asked: "How can we come to any understanding with you, as you have no authority to buy?" But they added: "If you know what you would give for our undertakings, mention it, and we will then consider carefully what you say; but we are not going to name a price to a body which has not the slightest power to buy. It would be wrong to do so." Then the Council asked them if they would attend the inquiry; and they said they would like to know what was to be its nature—whether it was to be a close or open inquiry. Since then the Council had approached the Corporation; and he thought that, after asking the Company to treat with them, they ought to have given the Company notice that they were going to the Corporation. There was one fallacy which the Directors wished to impress strongly on the meeting. They had heard that the Water Companies were going to make an immense amount out of the quinquennial valuation. He was in a position to say for that Company that they would not make anything. They would get something in this way: If a small house were pulled down, and a larger one built, this would cause an increase. Six miles of streets had been added to their district; and they would give an increase. But if it was thought that houses existing in 1885 would be put at a higher rate, and therefore would produce a higher rent, this was not the case as regarded the West Middlesex Company. When they met in May they would be told more exactly. But, so far as the Directors could see at present, the rates would go down. Of course, it could be easily imagined that where a small cottage was pulled down, and in its place a large flat erected, there would be an increase. The shareholders must understand that the greater portion of the Company's expenditure had been on new streets. He could not tell them how many new houses had risen—possibly 10,000—since 1885; and such a number must necessarily bring an increased rent. But it cost a large sum to lay down the pipes for them, and provide a supply of water. The Directors had lost one of their oldest colleagues—happily not by death; but he had been 43 years in the Company's service. Mr. Robert Hall had retired; and a superannuation allowance had been granted to him. Of the Company's unexpended capital, the small balance of £6070 remained; and before the 31st of March some considerable proportion of it would be spent. Therefore the Directors thought it right to raise the balance of the 4½ per cent. debenture stock—£50,150. This was the last of the capital they could raise without going to Parliament; and the Directors had made up their minds to spend it only on pipes for new districts. It was believed that this would carry them on for five years; and what would happen at the end of that period, he supposed no one there could tell. Three years ago the Directors were able, when they ceased to pay back dividends, to return a rebate of 5 per cent. to the consumers; but 5 per cent. meant more than £11,000 a year. The consumers had had this for three years; and the Board thought the time had now arrived when the rental was sufficient to enable them to make the rebate 7½ per cent. Therefore every consumer of water in the Company's district would get back 1s. 6d. out of every £1 he would otherwise pay. This would come altogether to about £17,000 a year—a large amount, they would probably say, to give back. He thought the consumers would do well to bear in mind that this would be lost to them if the Company became a part of one system of supply. Certainly, the West Middlesex Company's consumers had better not do very much to further the scheme, because it would be £17,000 a year lost to them directly. What he had always felt and dwelt upon was this—that this large rebate placed the West Middlesex Company in such a state of security that he did not know of any other Company, whether for the supply of water or anything else, which was in a like position. Let them remember that if, from unexpected circumstances, they saw their income go down, this rebate might be stopped directly. He had always held that their dividends were a guaranteed stock—they could not have less than 10 per cent. He was quite sure that, if the undertaking should be bought up, this would be an advantage to the West Middlesex proprietors, supposing they were to get income for income, which he thought was the lowest that could be offered. At the same time, the security the County Council would give would not, in his opinion, be so good as their own security—certainly not better. The Council were piling up such a heap of debt that there might be a time when the security they offered would not be so safe as it was now. At all events, he would much prefer to keep his West Middlesex stock than hold a security on the general rates of the Council. He concluded by moving the adoption of the report and accounts.

Mr. J. POMEROY seconded the motion.

The CHAIRMAN: I mentioned just now 10,000 new houses. I find the number is 6800.

The motion was then put, and carried unanimously.

The CHAIRMAN next moved the declaration of a dividend at the rate of 10 per cent. per annum on the consolidated stock of the Company, free of income-tax.

Mr. POMEROY seconded the motion, and it was agreed to.

Votes of thanks were then accorded to the Chairman, Directors, and Auditors, and the proceedings closed.

CAPE TOWN DISTRICT WATER-WORKS COMPANY, LIMITED

The Second General Meeting of this Company was held last Wednesday, at Winchester House, Old Broad Street, E.C.—Mr. J. S. PRINCE in the chair.

The SECRETARY (Mr. G. H. Rippin) having read the notice convening the meeting,

The CHAIRMAN moved the adoption of the report, which dealt with the affairs of the Company up to June 30 last. He said that, although the Directors had not been free from the anxieties and responsibilities which were sometimes encountered when engineering works of any magnitude were being executed, he could congratulate the shareholders upon the good progress which had been made with the construction of their works. A large quantity of plant had been delivered at the Cape to the satisfaction of the Engineer; and there were now more than 20 miles of pipes laid with water running through them to the Municipalities of Claremont and Woodstock. The pumping-station had been satisfactorily erected, and very excellent development had taken place at the Albion Springs—the Company's chief source of supply. The last gaugings showed a flow of 1,167,657 gallons daily against 500,000 gallons some time ago. The Engineer calculated that they might depend upon a continual flow of a million gallons per day. The Kometje Springs also gave them a good supply; and there were others in their area which they had no intention of developing at present. Of course, he was not able to give any estimate as to the revenue which the Company would derive; but, in the opinion of the Directors, they would earn a very fair dividend upon the capital invested. By cable advice received on the previous Friday, a contract had been entered into with the Cape Government Railway Department for water; the minimum quantity to be taken being 20,000 gallons per day, for which they were to pay £400 a year, and for any additional water consumed a further payment would be made. He also mentioned that under their concession, when any group of householders made an application for water, and guaranteed the Company 15 per cent. upon the outlay for laying the pipes, they were bound to comply with it. As the Directors had nearly exhausted the amount they originally estimated would be the cost of the works, in order to fulfil their obligations they proposed asking the shareholders to give their consent to the issue of the remaining 4000 shares as preference shares, which would give them powers to the extent of £20,000.

Mr. J. H. DURHAM seconded the motion, which was, after a brief discussion, unanimously carried.

The Auditors (Messrs. Deloitte, Dever, Griffiths, and Co.) having been re-elected,

An extraordinary general meeting was held to consider a resolution to the effect that the 4000 shares in the Company not yet issued be issued as preference shares, and that there be attached to these shares the right of the holders to a fixed cumulative preferential dividend at the rate of 7 per cent. per annum on the capital for the time being paid up thereon.

The CHAIRMAN, in moving the adoption of the resolution, said that they required more capital to carry on the concern, and to extend their mains to Rondebosch and Mowbray, which districts were not provided for in the original estimate.

Mr. DURHAM seconded the motion.

SIR RICHARD MEADE expressed the opinion that the effect of the resolution would be to put the holders of the original ordinary shares in a very unsatisfactory position; and he thought it a great misfortune to the Company that the shares should be issued as preferential ones.

The motion was carried (very few of the shareholders, however voting); and the proceedings then terminated.

NOTES FROM SCOTLAND.

From our Edinburgh Correspondent.

EDINBURGH, *Saturday*.

Of greatest importance in my district this week is the close of the Edinburgh Exhibition, arrangements for which were begun more than a year ago to give a fillip to electric lighting, but which has turned out such a miserable failure that the familiar remark about the rocket and the stick may be appropriately applied to it. The exhibition has been a failure in every sense. Financially the drop upon it is nearly £25,000; and a pretty scramble there promises to be over the winding up of the concern. Scientifically the failure was so signal that the Institute of Electrical Engineers would not appoint Jurors for it; and as one of the exhibitors said to me: "There's nothing worth looking at. Had the stuff been worth anything, there was enough of it to keep the Institute here a fortnight; but, God help you, they went over it all half in an hour." This remark very aptly described the affair. There was plenty of shop goods; but there was almost nothing of scientific value. Some of your readers may not have followed the matter in the Press; and for their benefit I may say that the exhibition has been brought into the Court of Session by a petition at the instance of the firm who erected the building, to have it wound up and a liquidator appointed. The exhibition owes this firm £9000; and being unable to pay it, the petition was presented in order to prevent the Bank running off with everything. This was before the close of the exhibition; since its close, the guarantors have met, and appointed a liquidator of their own, between whom and the builders there may be a stiff fight yet. It is being spread about that there is every likelihood of the concern being able to pay 20s. per £1; but I am afraid those who ventilate this view do not take into account the five or six actions for damages which are pending against the exhibition. It is apologetically explained that the failure of the exhibition is due to bad weather, insufficient railway service, and so forth. No one ever mentions that it was because there was nothing new to show. People had already seen all that was exhibited—even the electric lighting was no novelty; and therefore they did not frequent it. It was started as an electrical exhibition; and though, when it was seen that an exhibition of electrical appliances only would not draw, a quantity of other goods were admitted which had not the remotest connection with electricity, the notion remained in the minds of the public that it was an electrical exhibition only, and they felt that, as such, it was not worth attention. Two events show the depth to which the exhibition descended. The first took place last Saturday, on the last night of the show. So low were their finances that they could not pay their way; and the Brush Company, who had the contract for the general lighting, having a balance due to them of about £700, declined to turn on the light until a portion of it was paid. The Executive had not the money, and the exhibition was for an hour in darkness, and would have remained so for the whole evening had not Mr. Brown, of the firm of King, Brown, and Co., of Leith, who were themselves employed to provide incandescent lighting for a number of stands, become personally liable to the Brush Company for £100. When this was done, the exhibition was lighted up as usual. The other incident took place this morning, and is of a regrettable nature. Mr. S. Lee Bapty, the General Manager, terminated his engagement with the exhibition last night, and was about to step into a train for London this morning, on his way to Jamaica, where he has secured an engagement, when he was arrested at the instance of the Exhibition Executive on what is known as a *fuga* warrant—a process of Scotch law which enables a creditor to lay by the heels any debtor whom he may suspect of leaving the country without paying his debt. Mr. Bapty's debt to the exhibition consists of his bond of £500 to the guarantee fund. Of course, I am not in the secret, and do not know the reason for the step taken; but undoubtedly arrest was an extreme measure, and it is but a sorry ending to all the fine things which have been said of Mr. Bapty by members of the Executive. I have written enough to show what sort of a mess has been made of the affair. Though it would be too much to state that the failure is owing to its being an electrical exhibition, it is by no means stretching a point to say that the failure is largely due to that cause; and when it is remembered that, had the exhibition been a success, it would have been held by the devotees of electricity that the success was unmistakably a sign of the speedy triumph of electricity, and particularly of electric lighting, there can be no objection to others holding that the failure has shown electricity to be not yet in the running in any of the applied arts or industries.

The municipal elections are over, and so far as my district is concerned, they have been productive of little that is of interest to your readers. In Edinburgh there has been a good deal of grumbling at the quality of the gas, against which, as I have mentioned before, a dead-set is being made, it is supposed by some in the interests of electric lighting. One item of interest is the return of Mr. P. L. Henderson, architect, a son of Mr. Henderson, who was, for forty years, Engineer to the Edinburgh Gas Company. Mr. P. L. Henderson in his youth assisted his father in the gas-works; and he is consequently a fit man to place upon the Gas Commission. As Mr. Henderson's opinions may come to be of value, it may be as well to place them on record here, as he gave them to the electors. In his opinion, "the gentlemen composing the Gas Commission knew nothing earthly about gas;" and he believed that the weak point of the gas system lay with the distribution of the gas. His recommendation was that trunk mains should be laid throughout the town, and joined to the small mains, which would give ample pressure all over the city. He also thought too much had been paid for the Gas Companies' property; and that the gas should be of better quality and cheaper than at present. These to be sure, are but the vapourings of a candidate; but if he be placed on the Gas Commission, as he is almost certain to be, it will be interesting to see how he will proceed to improve the quality of the gas and lessen its price. I venture to prophecy that the laying of trunk mains throughout the city, at an enormous expense, will not go far in either of the directions he wishes. Perhaps one of the most regrettable incidents of the election is that Mr. Henderson has put Mr. Colston out of the Council. The vote was a narrow one; Mr. Henderson getting in by only two votes over Mr. Colston, who was, it must be said, only defeated by certain insinuations thrown out against him.

At a meeting of the Dundee Gas Commission last Wednesday, an arrangement was agreed to whereby the Commissioners are to work their own sulphate plant at the gas-works instead of the sulphate contractors. The latter are to pay the Commissioners £5 a-week and all expenses, which, as the plant cost £1500, is looked upon as a good return.

The dispute between the Partick, Hillhead, and Maryhill Gas Company and the Corporation of Glasgow with reference to the gas supply of the district, which came into the Court of Session in the form of an interdict by the Company against the forcible seizure by the Corporation of the service pipes which had been placed in the dwelling-houses in the district by the Company (*ante* p., 304), was mentioned by Lord Trayner yesterday. It was a plea of the Counsel for the Corporation that the service-pipes, though placed there by the Company at their own expense, were now the property of the owners of the tenements, and that they could take their gas supply from whom they pleased. Lord Trayner's opinion is that the pipes are part of the heritage, which is a giving away altogether of the Company's position, and should be brought under review. He proposes to call the tenants in, and then to allow a proof, at which they would be asked if they wanted their gas supply from the Company or the Corporation. Surely the learned Judge cannot seriously think of disposing of the case on such lines. Suppose in a tenement where there are six families, and three should ask for the Corporation gas, and the other three the Company's, who is to determine to whom the service-pipes should belong? Probably in that case the Corporation would require to put in a second set of service-pipes; but supposing that four of the tenants preferred the Corporation gas, and only two that of the Company, is there any authority for allowing the Corporation, in such a case, to seize the service-pipes and compel the Company, not only to relinquish the service-pipes they have already introduced, but to furnish a second set? Unless there be some such authority, his Lordship's decision would simply result in confusion; and now is the time, unless the Company are prepared to give in, for them to have the opinion of a higher Court upon his decision.

At the meeting of the Dunfermline Commission last night, the Lighting Committee reported that Mr. Hoey had submitted to them the table of figures to which I referred a fortnight ago, and that they had resolved to send the table to the Gas Company with the information that they had been charging 4½d. per 1000 cubic feet in excess of the average rate in the towns mentioned in the agreement, and asking a conference with them on the subject. There was a wordy warfare between Provost Alexander, who is a Director of the Company, and Mr. Hoey; and in the end the resolution to send the table to the Company was rescinded—the Lighting Committee being instructed to proceed anew with the question.

From our Glasgow Correspondent.

GLASGOW, *Saturday*.

It is rumoured that there have been additional *pourparlers* between the Partick, Hillhead, and Maryhill Gas Company, and the Glasgow Corporation Gas Committee, regarding the sale of the Company's works, plant, &c., to the city; but up to the present very little progress has been made in this direction. What is being waited on is a statement of the terms on which the Directors are willing to sell, or on what basis they are willing to begin practical negotiations. From what I can learn privately, the Gas Committee are not willing to agree to such favourable terms as were offered two years ago or thereby by the ex-Lord Provost (Sir James King), on behalf of the city, and which were accepted by the Directors of the Company, but rejected by a majority of the votes of the shareholders in an open meeting.

Provost Hogarth, of Ardrossan, has been telling the ratepayers of the town what the Burgh Commissioners have done in the way of making thorough provision for a good supply of gas. His statement is that three years ago the local gas-works were in a condition which made it impossible to give the town an adequate supply. There were altogether three gasholders; but two of them were so small that they were scarcely worth the room which they occupied. These have been removed, and one large holder put in their place. The storeage now is about three times as great as formerly; and the Commissioners are able to carry on the works, and let the community have the gas, without advancing the price. The Provost admits that the present price is rather high; but as the town extends, and a larger quantity of gas is made, the price will be reduced. A telescopic holder, a governor, a washer, and a new coal shed have been added; and now the works are in a very complete state and likely to produce gas for the next twenty years.

Ex-Bailie Calderwood, of Kilmarnock, who had for a time been out of the Town Council, offered himself for election again for the Fifth Ward, and went to the poll on Tuesday; but his candidature was not approved of, and he was left at the bottom of the poll. He supported his claim for re-election by referring to his connection with the gas-supply undertaking of the burgh. During the time that he served in the Town Council, along with Mr. Kennedy and Mr. M'Culloch (both of them practical engineers), he took a very deep interest in trying to improve the gas-works; and he brought on himself, he says, a great amount of obloquy because of the action which he took in the affair. There were some persons in the Ward, and others throughout the burgh, who cried out about the wilful waste of the public money; and they would almost have thought that the Committee were putting the money into their own pockets, and not applying it to the public interest. He was proud to think that the system adopted at the gas-works had proved a success; although Bailie Lawson at one time said that it was an experiment and should not have been gone into. Going on to refer to the Siemens system of firing the retorts, he said that he found from reliable statistics of the retorts worked on the system they were able to produce 25 per cent. more gas than by the old system. It took 30 per cent. less fuel to produce the gas, and less labour. He had also found from the Treasurer's report that the gas-works had, within the past few years, been able, independent of the reduction in the price of gas, to pay off, or at all events be in a position to pay off, £10,400. A position like that reflected very highly on the services of the gas manager, no matter what efficient machinery and everything else he could have for the production of gas. He affirmed

that the burgh of Kilmarnock was well off in having secured the services of such an efficient and faithful servant.

The Glasgow pig iron market has been very irregular during the week. Scotch warrants have fluctuated between 52s. 10½d. per ton paid on Wednesday, and 50s. 11d. yesterday; while the closing price in the afternoon was 51s. 1½d. per ton cash buyers. In Cleveland and hematite warrants, the fluctuations have been between 59s. 7d. and 58s. per ton for the latter, and 49s. 3d. and 48s. 2d. for the former. The closing prices yesterday were 58s. 2d. for hematite iron and 48s. 3d. cash for Cleveland warrants. There does not seem to be any prospect of the dispute in the blast furnace trade coming to a close at an early date.

No material change has taken place in the local coal trade this week. The shipments have fallen off to some extent; and prices are likely to decline still further, owing to the supply being in excess of the demand.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 8.

Sulphate of Ammonia.—The market looks considerably worse; and a rapid decline seems to be setting in, initiated by the sudden reduction of the London quotations by about 10s. per ton. This circumstance has evidently affected the country producers; for ordinary makes are now offering at £11 2s. 6d., while the quotations of best makes are still at £11 5s. f.o.b. Hull. Leith and Liverpool prices are down to £11 2s. 6d. There is still one ray of hope; and this is the probability that the present extremely low prices will attract consumers, and induce them to send their orders now—contrary to their intention of maintaining a passive attitude. The nitrate market continues extremely dull; and it is reported that spring delivery is quoted at 7s. 9d. per cwt. in Hamburg.

LONDON, *Nov.* 8.

Tar Products.—The market shows no improvement; and the dulness noted last week has continued during the present week. The lifelessness, however, does not inconvenience makers, as most of them are fully contracted to the end of the year. The stoppage of the Scotch iron furnaces has caused a large reduction in the heavy stocks of common oils, for which, however, there is a good inquiry at somewhat lower prices. Prices obtaining during the week are: Tar, 25s. to 30s. Pitch, 30s. to 32s. Benzol, 90 per cent., 4s. 5d.; 50 per cent., 3s. 4½d. Toluol, 2s. 1d. Solvent naphtha, 1s. 9d. Crude naphtha, 1s. 7d. Creosote, 2d. Heavy oils, 3d. Carbolic acid, 60's, 1s. 7½d. Cresol, 10d. Anthracene, 30 per cent., "A" quality, 1s. 4d.; "B" quality, 1s. 1d.

Sulphate of Ammonia.—The utterly demoralized condition of nitrate of soda, due to over-production and over-shipment, is seriously affecting the value of sulphate; and although makers are not stocked, very few have important contracts, and the selling from hand to mouth conspires—with the low price of nitrate—to lower prices being taken for sulphate. Business is reported at prices ranging from £11 to £11 5s. Ammonia liquor sells at from 6s. to 8s. 6d., according to position and strength.

Destruction of Messrs. W. Parkinson and Co's Premises by Fire.—By a fire which broke out about three o'clock last Saturday morning, the premises of Messrs. W. Parkinson and Co., in Cottage Lane, City Road, were entirely destroyed. The building was a three-storey one, 120 feet long and 40 feet wide; and it was used as workshops, offices, and stores. The fire was first detected by some passers by, and the night watchman at the gate of Messrs. Parkinson's yard, who immediately despatched messengers to the Fire Brigade Station in the Farringdon Road. When the firemen arrived, flames were shooting up to an enormous height from the factory. For a time some difficulty was experienced in getting water; but when this had been overcome, the flames were quickly subdued. It was not until near daybreak, however, that the fire was extinguished. It was then found that the premises were completely gutted, and that an adjoining manufactory, occupied by Messrs. Hancock, india-rubber manufacturers, had sustained severe damage. Messrs. Parkinson's stock and plant have been entirely destroyed; but, as will be seen by an advertisement which appears in another part of the JOURNAL, their drawings and correspondence have been saved. With the assistance of their Birmingham factory, supplemented by arrangements which have been already completed, the business will continue to be carried on with as little inconvenience and delay as possible.

Unloading Coke on the Public Footways in the Metropolis.—At the Westminster Police Court last Wednesday, William Fletcher, a carman, in the employ of The Gaslight and Coke Company, was summoned by the police for unloading a quantity of coke on the footway of Victoria Street, Westminster, between the hours of ten and six in the daytime; such thoroughfare being within the special limits of the Metropolis Streets Act (30 & 31 Vict., cap. 134, sec. 15). Mr. Horace Avory attended on behalf of the Company. It appeared that the defendant committed the alleged offence in delivering coke at St. Margaret's House, Victoria Street, and evidence thereof was given by Police-Constable Beeton. Mr. Avory said his answer was that the Act under which the proceedings had been taken mentioned coal, but said nothing whatever about coke. Mr. Sheil said coal was meant to include coke, though there did not appear to be any interpretation clause. Mr. Avory said coke did not mean coal, as anyone who ordered 2 tons of one and got the other would soon declare. Coke was no more coal than smoke would be coal. Mr. Sheil asked if Mr. Avory had any authority for his argument; and, on being answered in the negative, said he should decide against him. Inspector Field said the case was reported to the Police Commissioners in the ordinary way. Victoria Street was included in the special limits in August last year; and the fullest notification was given of the fact. Mr. Sheil fined the defendant 20s. and costs. Mr. Avory said this was the first time the question had arisen, so far as he was aware, and his clients would appeal. The simple question was whether coke was coal. Mr. Sheil said it was within the meaning of the Act.

The Price of Gas at Whitehaven.—A public meeting of the ratepayers of Whitehaven convened, in compliance with a requisition, by the Town Trustees, was held last Wednesday to discuss the present excessive price charged for gas by the Gas Company. Mr. Musgrave, who was called to the chair, addressed the meeting, and proposed a resolution expressing the opinion that the price of gas was excessive and unreasonable, and that efforts be made on behalf of the ratepayers and consumers to secure a reduction. The motion was carried; and a deputation was appointed to wait upon the Directors of the Company with the view of making a satisfactory arrangement for a rebate.

The Lancashire Coal Trade.—Business in the coal trade has been steady, and quotations for most descriptions do not show any change on those ruling a week ago. There has been more inquiry for house-fire coal of a medium quality; and in some directions an advance of 3d. to 6d. per ton has been obtained. The upward movement, however, is not at all general, and is not likely to be maintained in the present condition of the market. A fairly good business has been done in engine fuel; and for shipment there has been a distinct improvement. Best coal at the pit's mouth averages 12s. to 12s. 6d. per ton, with 11s. to 11s. 6d. for seconds, and 9s. to 10s. for the commoner sorts. Burgy averages 7s. 6d. to 8s.; and slack (of which there is a very large quantity on offer) ranges from 5s. to 7s. according to quality. Steam coal for shipment is quoted at 10s. to 11s. per ton delivered at ports on the Mersey.

The Oil Lighting Experiment at Erith.—We learn from the *Erith Times* that the oil-lamps at Erith are still working unsatisfactorily—in fact, are behaving no better than they did during the earlier days of the Local Board's experiment in public lighting by oil. During the past three months, 211 lamps have been found "not alight" or "gone out;" and the sum of £26 7s. 6d. has been deducted, as fines, from the amount due to the Trustees of the Defries Lamp Company, now in liquidation. The fine, as our readers may remember, is 2s. 6d. per night for every lamp which refuses to do its duty. One of the most recent offenders is the large lamp at the cross-roads at Belvedere, which has shown itself to be totally unreliable, although at this spot, of all other places in the district, good and constant illumination is of the utmost importance to prevent accident. It has always been a source of wonder to us that the general public treated this matter so lightly, when the subject of oil lighting is under discussion. If 211 gas-lamps, out of a total of (say) 375 had failed to perform their functions, the whole parish would have been furious, and the Gas Company would have been denounced in not too choice language. Why, then, should an Oil Lighting Company be treated so tenderly? Perhaps some of our correspondents can enlighten us on this point.

Southampton Gaslight Company.—The half-yearly meeting of this Company was held last Wednesday. The report of the Directors on the working of the six months ending June 30 stated that the profit and loss account showed that the amount available for dividend was £12,296. The Board recommended the payment of maximum dividends amounting to £7190 for the half year on all classes of shares, less income-tax, leaving a balance of £5106 to be carried forward. The Directors reported, with deep regret, the death of their esteemed and valued colleague, Mr. R. R. Oke, who for upwards of 33 years had been connected with the Company; and that they had elected Mr. J. C. Moberly in his place. The Chairman (Mr. R. C. Hankinson, J.P.), in moving the adoption of the report, said it was unusually satisfactory, because many companies had had to raise the price of gas owing to the increased cost of coal, strikes, and so on. The Directors had not had to do this, but had been able to carry forward a substantial balance. This was in a great measure due to the fact that they had entered into a favourable contract which would not expire till the middle of next year; and the shareholders would understand the advantage of this when he said that, to pay the present market price of coal, would make a difference of £6000 a year to the Company. The business, he also remarked, was extending; and they were about to build works for the conversion of their ammoniacal liquor into sulphate of ammonia. Dr. Trend seconded the motion, which was unanimously carried. Votes of thanks were passed to the Directors, to the Secretary (Mr. C. Crowther Smith), and to the Manager (Mr. S. W. Durkin).

Gas Laundry-Machines.—The Wandsworth and Putney Gas Company are the first of the London Gas Companies to adopt the hiring system for gas laundry-machines. On Wednesday and Thursday last, at the Town Hall, Wandsworth, four demonstrations were given by Mrs. Burdett, who lectured on the advantages of the Greenall system of washing, which consists in creating steam from water heated by gas, and revolving soiled linen in the steam. The four lectures were attended by several hundred residents and laundrymen; and many severe tests were applied to the machines. Several ladies brought samples of soiled body linen, with coarse kitchen towels, aprons, &c.; and the result after ten minutes washing was both surprising and pleasing. It was also shown that the work could be done at a moment's notice, without requiring a change of dress on the part of the operator. The washer was stated to be also useful for heating water for baths, cooking hams, and other purposes; while the gas-burner on the stand could be utilized for heating flat-irons, grilling, or boiling. At the close of the lectures, orders were given by gas consumers for 47 machines, which number is expected to be trebled in a few days. The fee for hiring was fixed at 2s. and 3s. per quarter. The demonstration was made exceedingly interesting by various exhibits by Messrs. Greenall, of Manchester, who shewed all sizes of gas washers, wringers, troughs, &c. Messrs. H. and C. Davis and Co., of Camberwell, exhibited their patent gas drying-horse, for drying linen in a short time. They also had for inspection a large assortment of gas irons, stands, boilers, and coppers. An item of interest was the "Excelsior" gas ironing-machine for laundrymen, shown by Messrs. Glover and Hobson, of the Old Kent Road, London. A polished cylinder, heated by atmospheric gas, revolved on a board holding two dozen collars. The assistant ironed all the linen as fast as it came from the Greenall washer and Messrs. Davis's gas dryer, so that the audience saw the work perfected during their stay. Mrs. Burdett was cordially thanked at the close of each demonstration.

Sewerage Works at Maldon (Essex).—The works of sewerage and of sewage disposal for the town of Maldon, Essex, were opened by the Mayor and Corporation last Tuesday. The works have been carried out from the designs, and under the superintendence, of Messrs. R. F. Grantham and Son, of Northumberland Avenue, by Mr. G. Osenton.

Galvanized Iron Water-Pipes for South Africa.—An important order has just been obtained from South Africa by Mr. Edward Smith, of the Brunswick Tube Works, Wednesbury, for 21 miles of water pipes and fittings, all constructed of galvanized iron. This large order has been placed on behalf of the Pretoria Water-Works.

Sales of Shares.—At the Auction Mart, Tokenhouse Yard, last Wednesday, Messrs. Edwin Fox and Bousfield offered for sale three-fourths of a King's share in the *New River Company*, divided into 20 lots each consisting of 1-120th of a share, and 7 lots each comprising 1-20th of a share. Of the former, one lot sold for £800; one for £790; six for £780; one for £770; two for £760; and three for £750. For the remaining six lots there were no bidders at the Auctioneer's price of £750 per lot. The larger lots met with no better success; for, of the seven lots, two only were sold—realizing £4500 each—and the others had to be passed over. There were also nine £100 new shares advertised to be sold; but these were withdrawn.——On the 4th inst., at the Auction Mart, Mr. Alfred Richards disposed of 1250 £10 shares in the *West Ham Gas Company*. There was a very good attendance; but the bidding was not at all brisk. The prices realized were as follows: 2 lots sold at £14 2s. 6d. per share; 86, at £14 per share; and 37, at £13 17s. 6d. per share.——At the Norfolk Hotel, Littlehampton, on Monday last week, Mr. C. H. Knight offered for sale by auction 160 £5 shares in the *Littlehampton Gas Company, Limited;* being the additional capital required on the completion of the new works. The shares were sold in lots of four. The bidding for lot 1 started at £6 15s. per share, and closed at £7 5s., at which the lot was knocked down; the buyer taking the next lot at the same price. The next five lots were bought at £7 3s. per share, at which figure most of the remaining lots were disposed of.

The Dangers of Electric Lighting.—On the evening of the 1st inst., a fire broke out in the basement of the Grand Café, which occupies the ground floor of the Jockey Club on the Boulevard des Capucines, Paris. The electric accumulators used for lighting the establishment are in this basement; and the fire is supposed to have originated through some defect of the apparatus. The café, as usual in the evening, was thronged with people, who at the sight of the flames rushed out on the Boulevard, causing great excitement and alarm. A crowd quickly collected, and for a time the traffic was interrupted. A force of police was speedily on the spot to keep order; and, thanks to the prompt arrival of the fire brigade, all danger of the fire spreading was soon removed. The damage done, however, is estimated at 30,000 frs. This accident gave rise to a short discussion in the Municipal Council last Friday evening, and a resolution was passed declaring that, in view of the dangers that may spring from the installations for electric lighting in Paris, the Legislature ought to pass a special law assimilating the production of electricity for lighting purposes to those industries which are considered "dangerous;" thus entailing their close inspection by the Prefecture of Police.——On the arrival of the White Star steamer *Teutonic* (having on board Mr. and Mrs. Henry M. Stanley) at New York on Wednesday last, it was stated that not only had the passage been exceedingly rough, but that some alarm had been caused by the ignition of the woodwork of the deck through an electric lighting wire.——According to the *West Middlesex Advertiser*, the landlord and employees of the Markham Arms are not likely to forget the night of Monday, the 20th ult. Late in the evening, just before turning out the lights, something unusual was noticed to be the matter with the electric incandescent lamps. Mr. Dew went to the switch and turned it off, but not before the lamps which were attached to the three large gas chandeliers in the bar were smashed to pieces, and streaks of fire upwards of a yard long had been streaming from the tubes, to which the platinum wire had been fastened, previous to its being broken and carried away with the globe. The box by the side of the switch was burned; and great damage was done both up and down stairs. Mr. Dew, the housekeeper, and others residing on the premises, are at a loss to know the cause of the fire; and they state that, if the enormous pressure of electricity had been kept up half a minute later, or if Mr. Dew had not turned the switch when he did, nothing could have saved the house from being destroyed by fire. "Three of us were standing in the bar at the time," remarked the housekeeper to a reporter, "and it was an awful sight. I prefer the old gas to this; it's much safer."

Electric Lighting at Preston.—The Streets Committee of the Preston Corporation have approved of a "temporary installation" of electric lighting in Fishergate, one of the main thoroughfares in the town, by the National Electric Supply Company, Limited.

Wirksworth Water-Works.—The Local Board of Wirksworth have called in Mr. W. H. Radford, C.E., of Nottingham, to report on the best method of increasing the supply of water. The springs supplying the present works have run down to 52,800 gallons per day; and the Local Board wish to obtain an increased supply of from 24,000 to 36,000 gallons a day.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 990.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Oct.	10½	Alliance & Dublin 10 p. c.	10	16–17	..	6 3 6
100,000	10	,,	7½	Do. 7 p. c.	10	12–13	..	5 15 6
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107–109	..	4 11 9
100,000	20	30 May	8	Bahia, Limited	20	20–22	..	7 5 5
200,000	5	15 May	7½	Bombay, Limited	5	6¾–7¼	..	5 3 5
40,000	5	,,	7½	Do. New	4	5–5½	..	5 9 1
380,000	Stck.	14 Aug.	12½	Brentford Consolidated	100	212–217	..	5 12 11
1: 5,000	,,	,,	9½	Do. New	100	155–160	..	5 15 7
223,000	20	11 Sept.	11½	Brighton & Hove Original	20	40–42	..	5 9 6
320,000	20	28 Mar.	11½	British	20	43–45	..	5 0 0
50,000	10	11 Sept.	11	Bromley, Ordinary 10 p. c.	10	18–20	..	5 10 0
39,000	10	,,	8	Do. 7 p. c.	10	13–14	..	5 14 3
328,750	10	13 June	8	Buenos Ayres (New) Limited	10	11½–12½	–⅛	6 8 0
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	103–106	..	5 13 2
150,000	20	14 Aug.	8	Cagliari, Limited	20	25–27	..	5 18 4
550,000	Stck.	10 Oct.	13½	Commercial, Old Stock	100	248–253	+1	5 8 8
130,000	,,	,,	10½	Do. New do.	100	198–203	..	5 5 11
130,000	,,	27 June	4½	Do. 4½ p. c. Deb. do.	100	109–124	..	3 12 7
557,320	20	13 June	13	Continental Union, Limited	20	48–50	–½	5 4 0
242,680	20	,,	13	Do. New '69 & '72	14	34–36	..	5 1 6
200,000	20	,,	10	Do. 7 p. c. Pref.	20	39–41	..	4 17 7
75,000	Stck.	25 Sept.	10	Crystal Palace District	100	190–200	..	5 0 0
234,060	10	16 July	—	European, Limited	10	19–20	+⅛	—
120,000	10	,,	—	Do. New	10	18–20	..	—
354,060	10	,,	—	Do. do.	7½	13½–14½	–½	—
5,470,620	Stck.	14 Aug.	13	Gaslight & Coke, A, Ordinary	100	255–239	+1	5 8 10
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	98–101	..	3 19 3
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	247–252	..	3 19 4
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	119–123	..	4 1 3
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	177–182	..	4 2 5
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	164–168	..	4 3 4
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	246–251	..	3 19 8
1,061,150	,,	13 June	4	Do. 4 p. c. Deb. Stk.	100	113–120	..	3 6 8
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	123–128	..	3 10 4
650,000	,,	,,	6	Do. 6 p. c. do.	100	160–164	–1½	3 13 2
3,800,000	Stck.	15 May	12	Imperial Continental	100	221–224	+1	5 7 1
75,000	5	13 June	6	Malta & Mediterranean, Ltd.	5	5¾–5¾	..	5 4 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	109–111	..	4 10 1
541,920	20	13 June	6¼	Monte Video, Limited	20	19–20	..	6 10 0
150,000	5	30 May	10	Oriental, Limited	5	9–9¼	..	5 5 3
60,000	5	25 Sept.	7	Ottoman, Limited	5	5–5¼	..	6 7 3
166,870	10	16 July	4	Pará Limited	10	3–4	..	10 0 0
420,000	100	3 Nov.	6	People's Gas of Chicago—1st Mtg. Bds.	100	95–100*	..	6 0 0
500,000	100	2 Dec.	6	and Do.	100	95–100	..	6 0 0
150,000	10	10 Oct.	10	San Paulo, Limited	10	15¾–16¾	..	6 1 2
500,000	Stck.	28 Aug.	13½	South Metropolitan, A Stock	100	283–288	..	4 12 0
1,350,000	,,	,,	11½	Do. B do.	100	228–233	..	4 18 9
141,500	,,	,,	12	Do. C do.	100	235–245	..	4 17 11
650,000	,,	27 June	5	Do. 5 p. c. Deb. Stk.	100	142–147	..	3 8 0
60,000	5	11 Sept.	11½	Tottenham & Edm'nton, Orig.	5	11–13	..	4 8 5
						*ExDiv.		
				WATER COMPANIES.				
728,446	Stck.	13 June	9½	Chelsea, Ordinary	100	271–276	..	3 8 10
1,720,560	Stck.	10 Oct.	7½	East London, Ordinary	100	211–216	..	3 9 5
544,440	,,	27 June	4½	Do. 4½ p. c. Deb. Stk.	100	142–147	..	3 1 2
700,000	50	13 June	9	Grand Junction	50	121–126	..	3 11 5
708,000	Stck.	14 Aug.	10½	Kent	100	271–276	..	3 16 0
1,043,800	100	27 June	9½	Lambeth, 10 p. c. max.	100	252–257	..	3 13 11
406,200	100	,,	7½	Do. 7½ p. c. max.	100	197–202	..	3 14 3
225,000	Stck.	25 Sept.	4	Do. 4 p. c. Deb. Stk.	100	120–124	..	3 4 6
500,000	100	14 Aug.	12½	New River, New Shares	100	361–369	..	3 6 3
1,000,000	Stck.	31 July	4	Do. 4 p. c. Deb. Stk	100	125–128	..	3 2 6
902,300	Stck.	13 June	6	S'thwk & V'xhall, 10 p. c. max.	100	170–174	..	3 9 0
126,500	100	,,	6	Do. 7½ p. c. do.	100	158–163	..	3 13 7
1,153,666	Stck	13 June	10	West Middlesex.	100	265–270	..	3 14 1

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAYS.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.

Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.

JOHN WM. O'NEILL, Managing Director.

CANNEL COAL, ETC.

JOHN ROMANS & SON, EDINBURGH. Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.

Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, } SCOTLAND.
NEWTON GRANGE, NEAR DALKEITH, }

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.

Postal Address: 1, WHITTINGTON AVENUE, E.C.

Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON,

Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.

*** See Advertisement p. 963 of last week's issue.

Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importers from Ireland. Sample and Price on application. Spent Oxide and Sulphate of Ammonia purchased. 120 and 121, NEWGATE STREET, LONDON, E.C.

TUBES.

FOR Gas, Steam, and Water; Galvanized White Enamelled, and Hydraulic Tubes, &c. JOHN SPENCER, Globe Tube Works, WEDNESBURY, and 14, Great St. Thomas Apostle, LONDON.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON." TELEPHONE No. 2698.

GWYNNE & CO.,

HYDRAULIC AND GAS ENGINEERS,

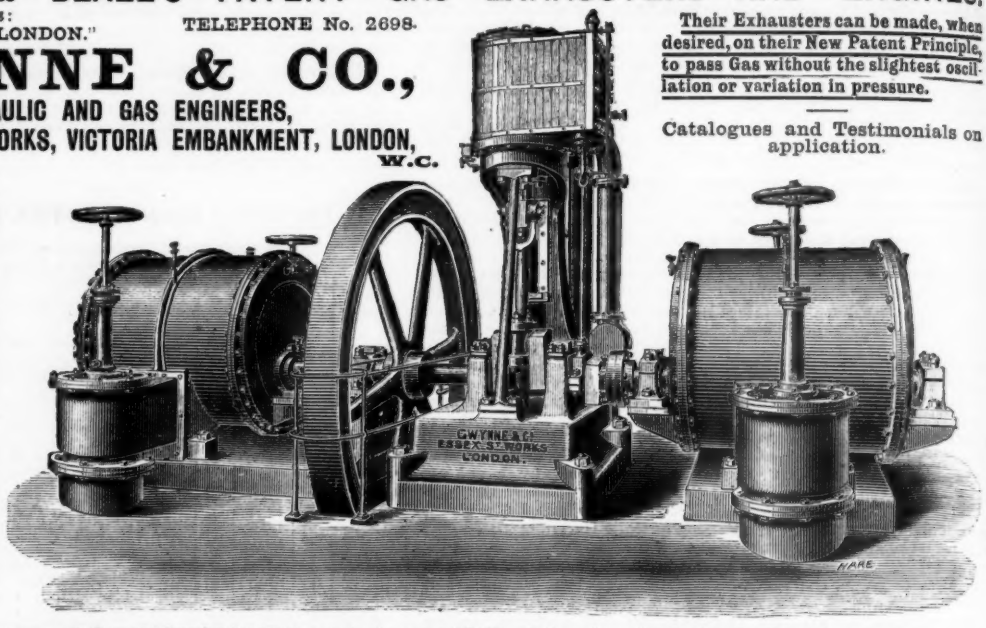
ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co. for Gas Exhausters, &c.

They have completed Exhausters to the extent of 29,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.



Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

Catalogues and Testimonials on application.

Exhausting Machinery at Fulham and Bromley Gas-Works—each set passing 400,000 cub. ft. per hour, drawing 14 miles distant from Beckton.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 85, Gracechurch Street, LONDON; 70, Wellington Street, GLASGOW; 10, Marsden Street, MANCHESTER; and 96, Reade Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.

Head Office: MIDDLESBROUGH. Correspondence invited.

TAR and Liquor wanted.
BROTHERTON AND CO., Commercial Buildings, LEEDS.

WANTED, by a young Man (aged 24), a Situation as INSPECTOR and COLLECTOR, or leading FITTER. Well up in interior and exterior Fitting, Estimates, &c. First-class references.

Address No 1877, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a Competent Man, a Situation as SERVICE LAYER, METER FIXER, INDICE READER, MAIN TESTER, &c. Fifteen years' experience in general outside work. Eleven years at last situation.

Address J. K., 14, Station Street, STRATFORD, E.

WANTED, a Situation as a Retort HOUSE STOKER. Used to Shovel Charging, and to Engine and Exhauster. Fifteen years' experience. Teetotaler. Good references.

Address J. P., 20, Potter Street, Garlside Street, MANCHESTER.

SCOTCH GAS COALS.

A Gentleman connected with Gas Companies in South Wales would treat with view to AGENCY OF SCOTCH GAS COALS.

Address No. 1876, care of Mr. King, 11, Bolt Court FLEET STREET, E.C.

TRAVELLER.

GOOD Experienced Representative wanted to sell new ADAPTABLE REGENERATIVE GAS-LAMP.

Apply personally to the DEIMEL LIGHT COMPANY, LIMITED, 86, GRAY'S INN ROAD, W.C.

WANTED, a large second-hand WASHER, in perfect condition.

State price and full particulars to J. HARDMAN AND Co., Tunstall, STOKE-ON-TRENT.

WANTED, to purchase Gas Carbon delivered at nearest Station to Gas-Works, in quantities of not less than 4 tons.

Address, stating price per ton and quantity, No. 1766, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ON SALE, at the Atherton Gas-Works, a SINGLE-LIFT GASHOLDER, 40 feet diameter and 14 feet deep, in good condition.

Apply to the CLERK of the Local Board, Atherton, LANCS.

J. & J. BRADDOCK, Globe Meter Works, Oldham.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Address: "Braddock, Oldham."

FOR SALE—A Steam-Boiler, 9 ft. by 4 ft. (2 feet Flue in centre), with Safety-Valve, Gauges, &c., all complete. Equal to new. Too small for present use.

Apply to the GAS-WORKS, Littleborough, near MANCHESTER.

TAMWORTH GASLIGHT AND COKE COMPANY.

THE Directors are desirous of receiving TENDERS for the supply of NEW GAS-METERS, and REPAIRS to OLD ONES, for Twelve Months from the 1st of December next. Also for the supply for the same period of GAS TUBES and FITTINGS.

Tenders to be sent to me on or before the 18th inst.

WILLIAM ARNOLD, Secretary.

23, George Street, Tamworth,

TO INVESTORS, TRUSTEES, AND OTHERS.

ISSUE OF DEBENTURE BONDS.

THE Directors of the Swansea Gas- light Company are now issuing DEBENTURE BONDS, in sums of £100 up to £1000 to suit investors, for three, seven, or ten years, at 3½ per cent. interest per annum, payable half-yearly, secured on the Undertaking of the Company.

By order,
THORNTON ANDREWS, Secretary.

Swansea, Oct. 23, 1890.

PATENTS, DESIGNS, AND TRADE MARKS ACTS, 1883 TO 1888.

NOTICE is hereby given, that Hector Leak, of Dingle House, Winsford, Cheshire, has applied for leave TO AMEND THE SPECIFICATION filed in pursuance of the Application for Letters Patent No. 9227, of 1890, for "Improvements in Street and Other Lamps, also partly applicable to Incandescent Electric Lamps."

Particulars of the proposed amendment were set forth in the Illustrated Official Journal (Patents) issued on the 22nd of October, 1890.

Any person may give notice (on Form G) at the Patent Office, 25, Southampton Buildings, London, W.C., of opposition to the amendment within One month from the date of the said Journal.

(Signed) H. READER LACK,
Comptroller-General.

FOR Distribution among Gas Consumers or at Exhibitions.—A 4pp. Leaflet entitled "THE USE OF GAS-STOVES IN OUR HOMES;" being a reprint of an article from the *Home Provider*. Price 8s. 6d. per 100 Special quotations for larger quantities, and, if required, for printing Gas Company's own announcement on first or last page. Specimen copy, free by post, 1½d.

The Leaflet is very suitable for distribution among Gas Consumers in the provinces, as it shows the great progress which is being made in the use of Gas for Cooking and Heating in London, and points out, briefly and clearly, the many advantages of Gas-Stoves.

May be obtained of S. H. E. FOXWELL, Office of the *Home Circle and Provider*, 48, Temple Chambers, TEMPLE AVENUE, E.C.; and of WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

COZE'S Automatic Apparatus for CHARGING AND DISCHARGING GAS-RETORTS. For Illustrated Advertisement of this System, see p. 932.

Inquiries should be addressed to THE AUTOMATIC COAL-GAS COMPANY, LIMITED, 86-88A, LEADENHALL STREET, E.C.

HUTCHINSON BROTHERS, Barnsley, Gas Engineers and Contractors, Makers of Wet and Dry Gas-Meters and General Gas Apparatus, Sulphate of Ammonia Plant, Lead Saturators, Tanks, &c., Tools and Sundries.

BENTLEY & CO.

MANCHESTER ELECTRICAL STORES.

FOR Batteries, Bells, Wires, and Special Electrical Apparatus, address the best house 17, NEWTON STREET, PICCADILLY, MANCHESTER.

EXTRACT from the Harrogate Gas Company's Report, dated the 5th of February, 189 : Coal consumed, 8600 tons. Gas made, 92,880,000 feet; ditto sold, 84,880,000 feet; ditto unaccounted for, 8,000,000 feet; quantity made per ton, 10,800 feet; ditto sold, 9869 feet. Illuminating Power, 16·1 candles. Coals used, Brancepeth. Owners, Strakers and Love, Newcastle-on-Tyne; who have also Brandon Hutton Seam Unscreened Gas Coal. Analysis, 10,500 cubic feet per ton; Illuminating Power, 16·2 candles.

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IMPERIAL CONTINENTAL GAS ASSOCIATION.

INCORPORATED BY ACT OF PARLIAMENT.

NOTICE is hereby given, that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Association was held at the City Terminus Hotel, Cannon Street, London, on Tuesday, the 4th inst.

Sir JULIAN GOLDSMID, Bart., M.P., in the chair—When the following Resolutions were unanimously passed:—

"That this Meeting records, with deep regret, the loss sustained by the Association through the recent death of the Deputy-Chairman, Mr. H. Wood, and that the sincere sympathy of the Proprietors be offered to his widow and family."

"That the Report of the Directors upon the affairs of the Association be received, adopted, and entered upon the Minutes."

"That a Dividend of £5 per cent. for the half year ended the 30th of June last, and a Bonus of £1 per cent. be declared upon the £3,800,000 Stock of the Association, and that the said Dividend and Bonus be payable, free of Income-Tax, on and after the 1st of December next."

"That the cordial thanks of the Meeting be given to the Directors for their able management of the affairs of the Association, to the Chairman for his conduct in the chair this day, to Mr. H. V. Lindon, Mr. L. G. Drory, the Agents, Engineers, and other Officers of the Association on the Continent, and to the Secretary and the London Staff."

By Order of the Board,
R. S. GARDINER, Secretary.

30, Clements Lane, Lombard Street, London, E.C., Nov. 5, 1890.

COKE BREAKERS,

PRICES REDUCED.

(THOMAS & SOMERVILLE'S PATENT.)

New Design, with two Cutting Rollers, making less Breeze than their old pattern.

GEORGE WALLER & CO.,

PARK STREET, SOUTHWARK, E.C.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

MIRFIELD, NORMANTON.

NEWBATTLE CANNEL.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter; and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

PATENTS FOR INVENTIONS,

REGISTRATION OF TRADE MARKS and DESIGNS in all Countries.

SEARCHES made *re* novelty, and opinions given on all matters connected with above. *Full particulars on application to*

J. C. CHAPMAN,

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Special experience in Gas and Ammonia Plant.

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Grassmoor Company, Ltd.,

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Have still a limited quantity of their

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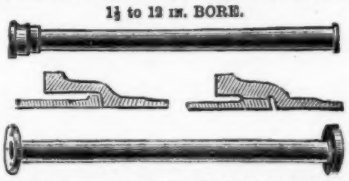
GAS COAL

In Reserve.

ANALYSIS AND SAMPLES ON APPLICATION.

GAS AND WATER PIPES.

1½ to 12 IN. BORE.



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FOR PURIFYING COAL GAS.

As extensively used in Yorkshire, Lancashire, the Midlands, and Abroad.

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For **FIRE-BRICKS,** the most durable for **GAS-FURNACES,**

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Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

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BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

For Prices and complete Analysis, apply to

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PATENT PURIFYING MACHINE,

Which has now fully proved itself to be the most effectual, powerful, and perfect Apparatus in the World,

FOR PURIFYING GAS FROM

TAR, CARBONIC ACID, AMMONIA,

and a large portion of

SULPHURETTED HYDROGEN,

Doing all the work of Purification between the Condensers and Purifiers, and relieving them of much work. Its cost is less than any other known Apparatus for purifying Gas from Tar and Ammonia.

Testimonials, Drawings, and Prices on Application.

8, Finsbury Circus, London, E.C.; Midland Iron-Works, Donnington, near Newport, Shropshire.

Price 2s. per dozen, or 10s. 6d. per 100, post free.

CONSPIRACY and Protection of Property Act. It is required, under a Penalty of FIVE POUNDS, that a Printed Copy of the 4th Section of this Act shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by the persons employed thereat.

Printed copies of this Section, in large type, on broad sheets, may be obtained of WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

*** *The Act extends to Scotland and Ireland.*

THOMAS ILLINGWORTH,
NORTH DEAN CHEMICAL WORKS,
Near HALIFAX,
MANUFACTURER OF SULPHURIC ACID
OF EXTRA QUALITY FOR MAKING
WHITE SULPHATE OF AMMONIA.

TAR, LIQUOR, AND SPENT OXIDE
Purchased for Cash against Delivery.

THE BEST AND SIMPLEST SYSTEM OF
VALVES FOR PURIFIERS
Is Weck's Patent arrangement of Three-Way Disc Valves, either separate for Purifiers fixed in line, or arranged together as a
CENTRE-VALVE
When the Purifiers are fixed in square.

No Leakage. No Foul Gas passed in changing. All the Purifiers in action, or any less number. Clean Box emptied of Air before taking into use.

DESCRIPTIVE PAMPHLET ON APPLICATION.

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LIMITED.
LANEMARK CANNEL AND GAS COALS.
Quotations and Analysis on application to
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NEW CUMNOCK, N.B.
Shipping Ports: All the principal Scotch Ports.

HOLMSIDE GAS COALS.

THE Owners of Holmside and South Moor Collieries possess an undivided area of nearly 5000 acres of COAL in the County of Durham, over the greater portion of which area the most of the best Coal of the district, including the well-known Hutton Seam, remains almost untouched; and as preparations are being made for working the Hutton Seam on a large scale, it is expected that the reputation of HOLMSIDE GAS COALS will be still further increased. The Holmside and South Moor Collieries have been in the hands of the same families for over half a century; but, until lately, no adequate attempt has been made to open out their very large Coal-Field, notwithstanding that the best Coal of the district around them, and especially the Hutton Seam, has been for some time past seriously diminished by reason of the vigorous workings of neighbouring coal-owners. Holmside Gas Coals are now being worked out of Holmside and South Moor Collieries at a rate of about 2200 tons per working day—a rate totally inadequate to meet the existing demand. By an extensive development of workings in the Hutton Seam, it is hoped that the demand may be fully met, and the quality raised to the highest point attainable by Durham Coal.

For price and particulars, apply to MARK ARCHER, Holmside and South Moor Offices, Quayside, NEWCASTLE-ON-TYNE.

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VALVES
FOR GAS, WATER, AND STEAM.
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THE SILICA FIRE-BRICK COMPANY,
OUGHTIBRIDGE, near SHEFFIELD
MANUFACTURE
SILICA BLOCKS, BRICKS, AND CEMENT
OF SUPERIOR QUALITY
FOR GAS-FURNACES.
Trade Mark: "SILICA."
These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their
GREATER DURABILITY,
Strongly recommended where EXCESSIVE HEATS have to be maintained.

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Brettell's Estate
FIRE-CLAY & BRICK WORKS,
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Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

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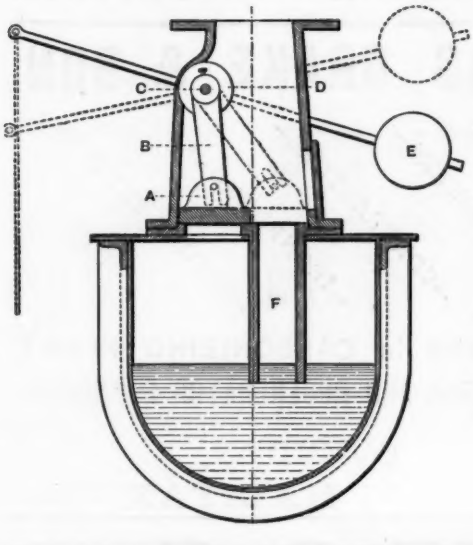
Geo. R. HISLOP, Gas Engineer, PAISLEY, N.B.



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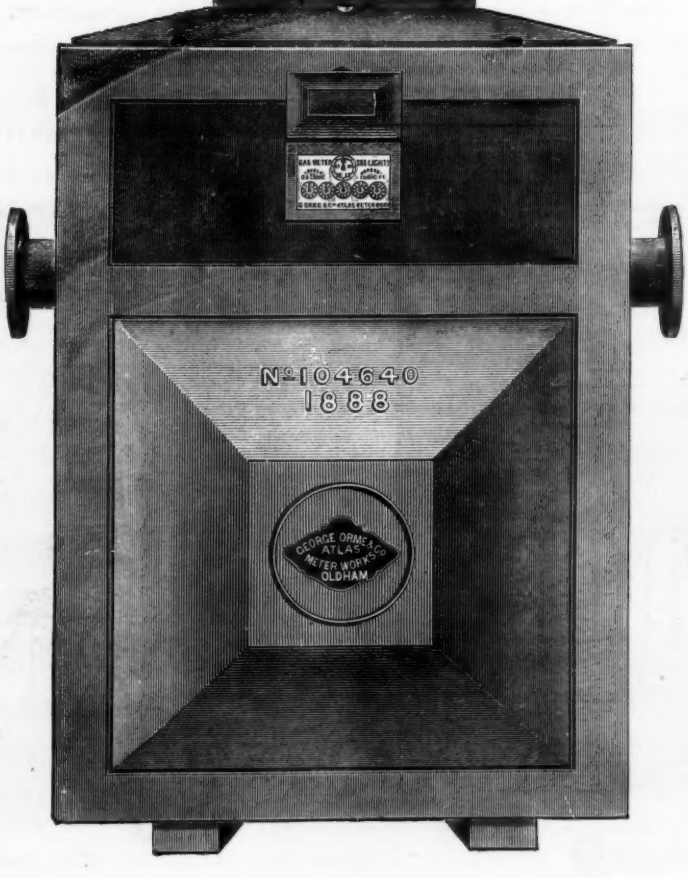

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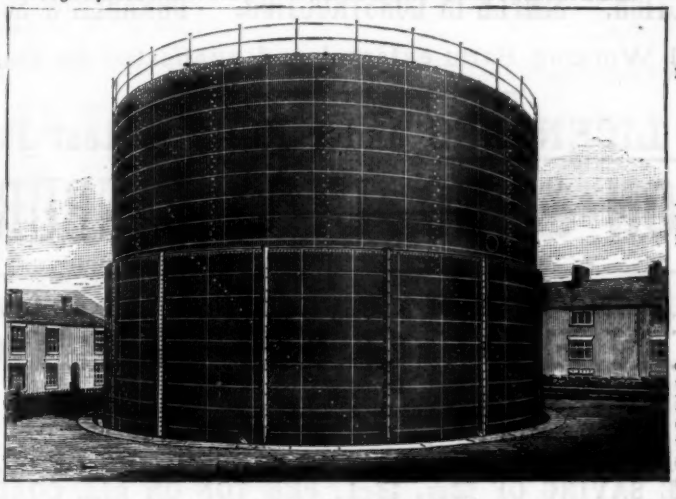

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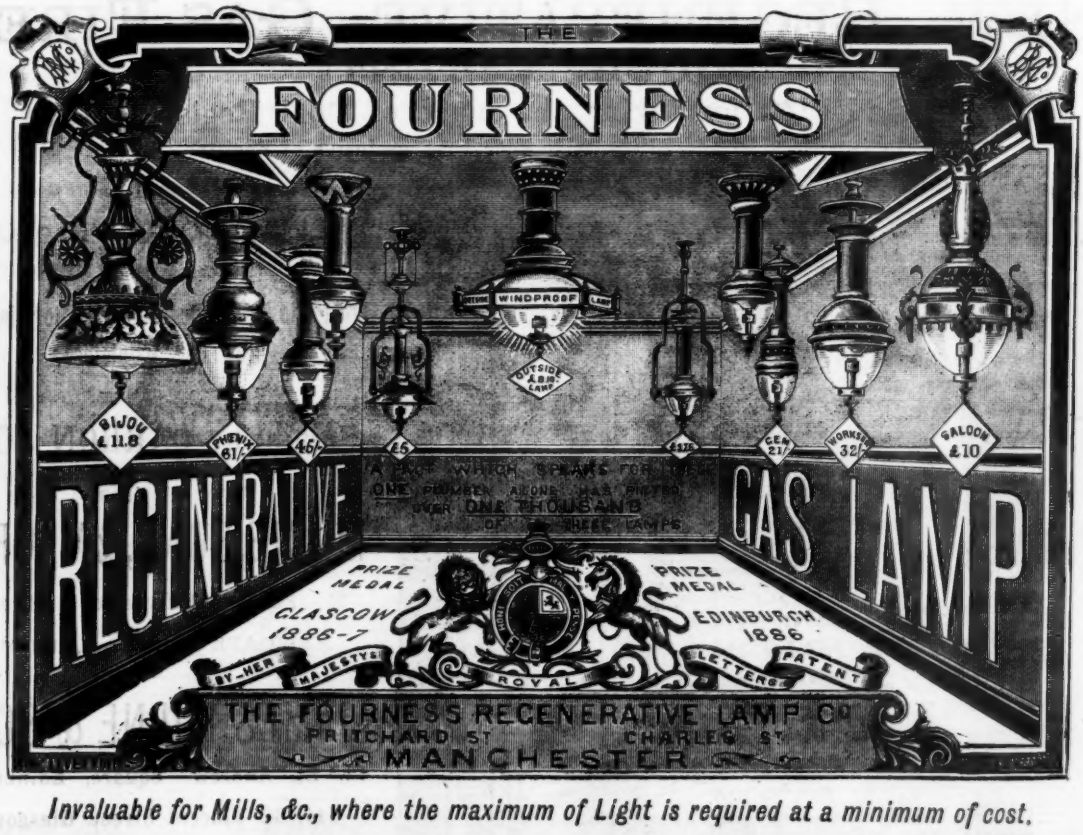

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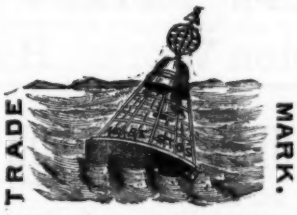

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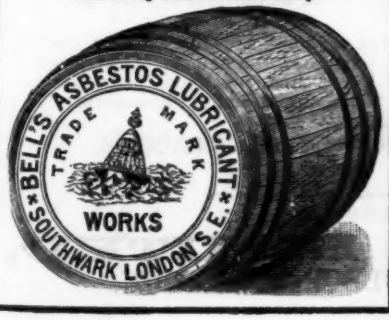

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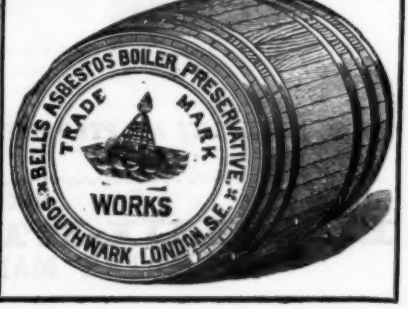

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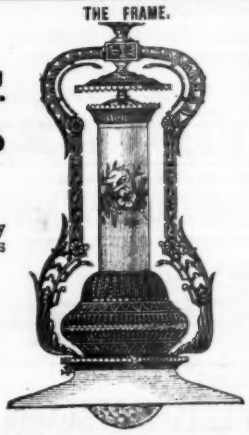

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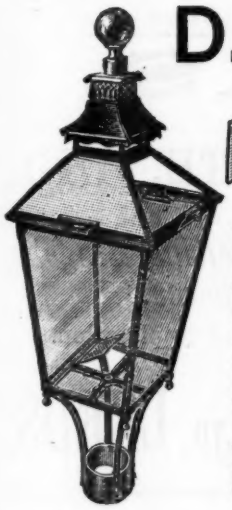

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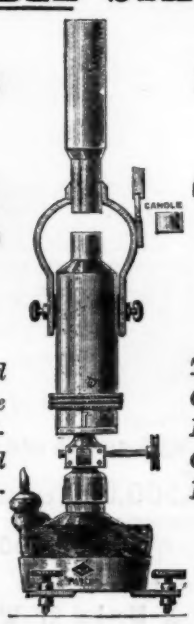

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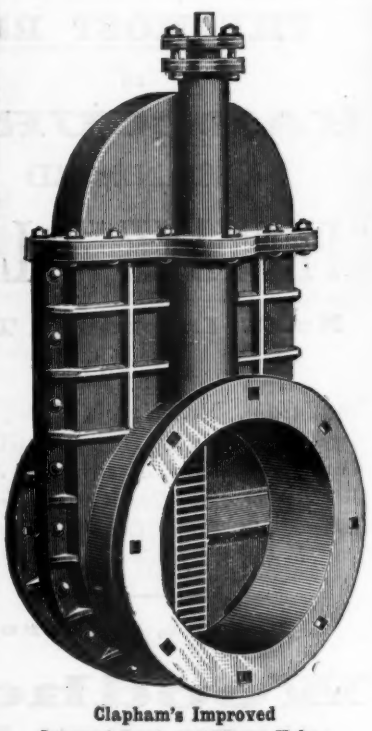
SILVER MEDAL, Inventions Exhibition, 1885.



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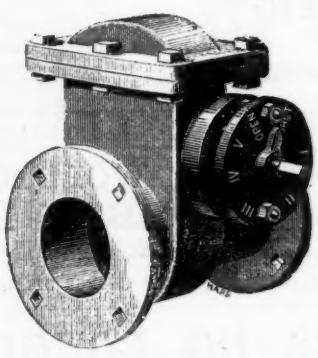

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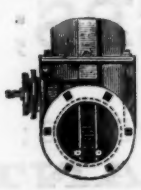

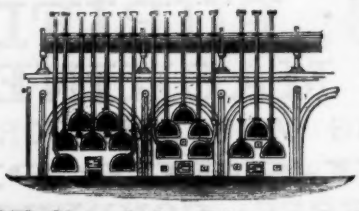

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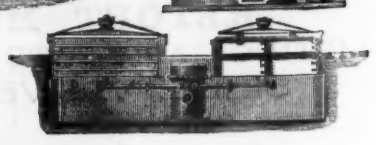

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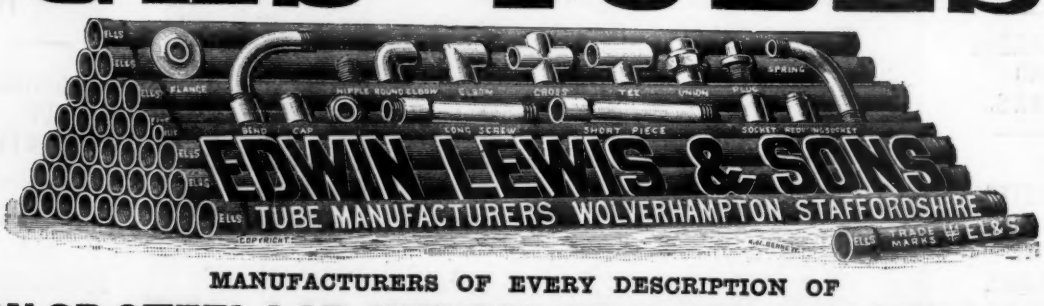

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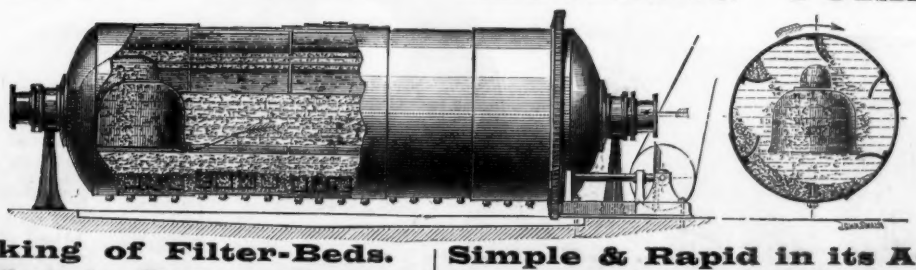

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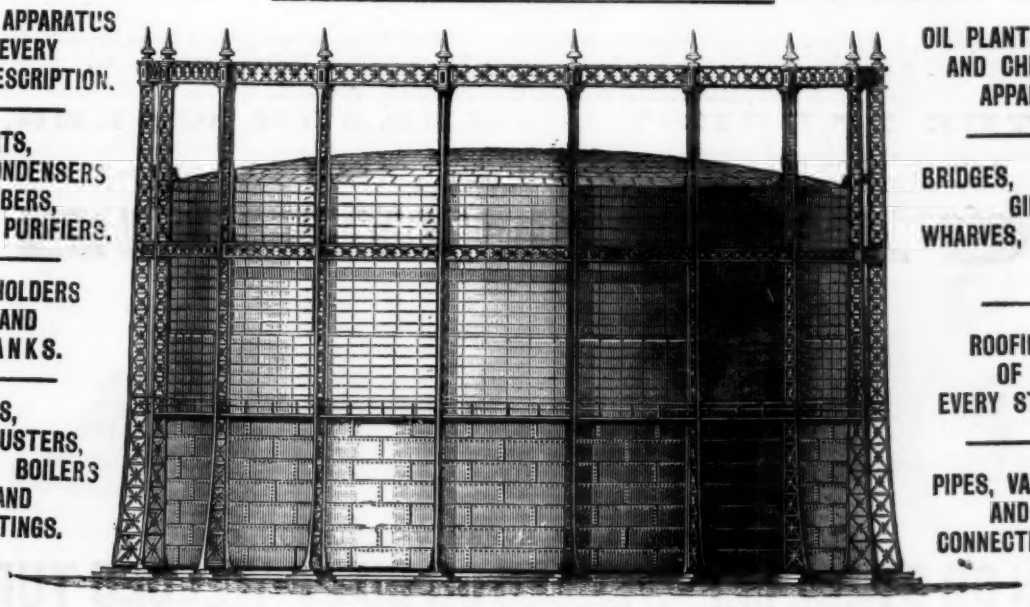

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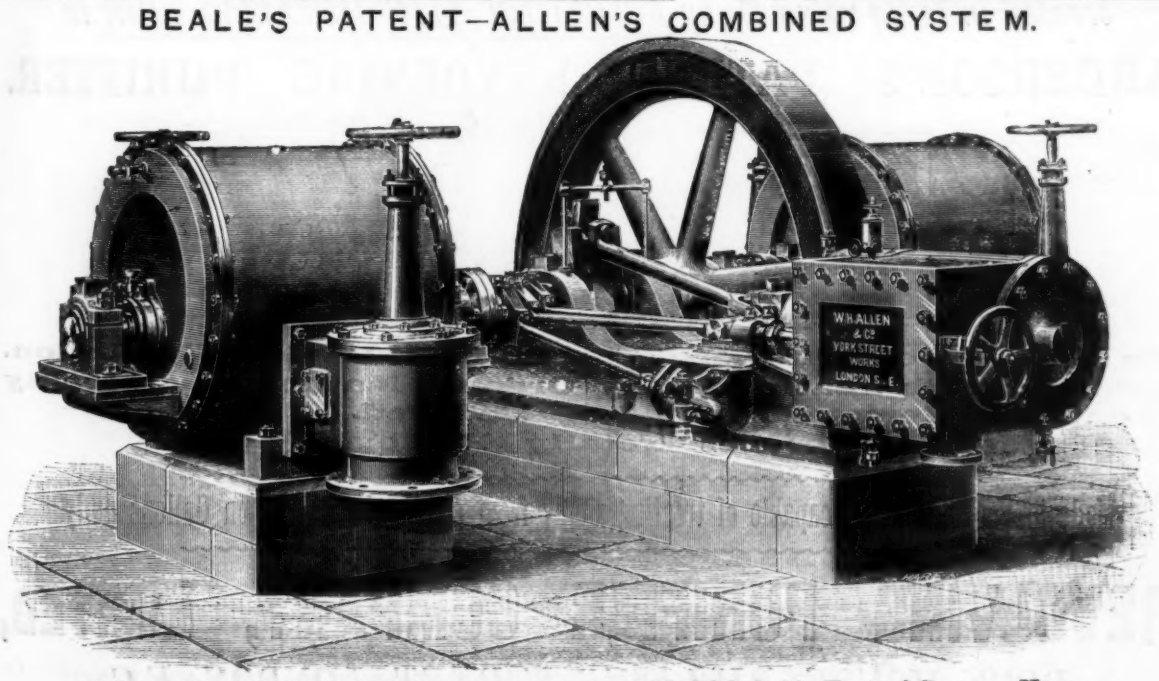

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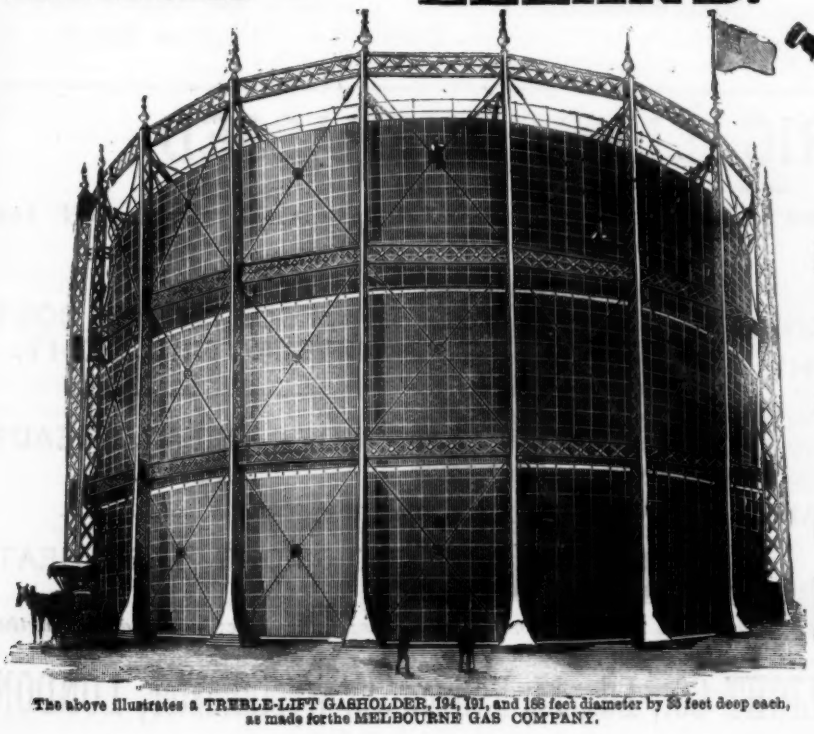

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